¶ A very neceſſarie and *profitable Booke concerning* Nauigation, compiled in Latin by Ioannes Taiſnierus, a publike profeſſor in Rome, Ferraria, & other Uniuerſities in Italie of the Mathematicalles, named a treatiſe of continuall Motions.

Tranſlated into Engliſhe, by
Richarde Eden.

The contentes of this booke you ſhall finde
on the next page folowyng.

¶ Imprinted at London by
Richarde Iugge.

Cum priuilegio.

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1 Of the marueylous nature and vertue of the Lode ſtone, called in Latin Magnes, where they be found, and howe to knowe the beſt.

2 Of continual motion by the ſayd ſtone, Magnes.

3 Of the due proportion of whatſoeuer Shyp, and the diſcloſyng of certayne Mathematicall ſecretes.

4 Of ebbyng and flowyng, with their diuerſities, and the cauſes thereof.

5 Demonſtrations of proportion of motions local, confutyng the opinion of Ariſtotle therein.

To the ryght woorſhipfull Syr *Wylliam Wynter, Knyght, Maiſter* of the Ordinaunce of the Queenes Maieſties Shippes, and Surueyor of the ſayd Shippes.

Richarde Eden wyſheth health and proſperitie.

It is nowe about twelue yeeres paſte (gentle Maiſter Wynter) ſince the curteſie and fauour which long before I founde at your hande, mooued me no leſſe for the good wyll that I haue euer borne you and your vertues, to excogitate or deuiſe ſomethyng, within the compaſſe of my poore abilitie, that myght be a witneſſe, & as it were a ſeale, to teſtifie both that I haue not forgotten your gentleneſſe, & alſo howe deſyrous I am to pay the debtes of freendſhyp which then I promiſed you, & alſo attempted to perfourme: But beyng at that tyme preuented, by meanes of my ſodayne departyng out of Englande, with my good Lorde the Vidame, with whom I remayned for the ſpace of ten yeeres, vntyll the calamities of that miſerable countrey, with loſſe of goods, and danger of lyfe, hath dryuen me home agayne into my natiue countrey: Where fyndyng my ſelfe at ſome leyſure, and deſyrous to paſſe foorth parte of my tyme in ſome honeſt exerciſe, which myght be profytable to many, domagable to none, and a meanes to geat me newe freendes, the olde in my ſo long abſence, in maner vtterly waſted: I chaunced in the meane tyme, to meete with my olde acquayntance and freend, Richard Iugge, Printer to the Queenes Maieſtie, who had many yeeres before, printed the Booke of Marten Curtes, of the Art of Nauigation, by me tranſlated out of the Spanyſhe tongue. Whereof, hauyng with him ſome conference, he declared that he woulde prynt that booke agayne, yf I woulde take the paynes to deuiſe ſome addition touchyng the ſame matter, that myght be ioyned thereto. At whiche tyme, hauyng with me in the Latine tongue, theſe bookes here folowyng printed, whiche I brought with me out of Fraunce, I ſoone agreed to his honeſt requeſt, to tranſlate them into Englyſhe: Whiche beyng accomplyſhed, this onely remayned, accordyng to the common cuſtome, to conſecrate and dedicate the ſame to ſome worthie perſonage, whoſe fame, authoritie, and dignitie, myght defende them from the euyll tongues of ſuch as are more redie rather to reproue other mens dooynges, then to doo any good them ſelues. And therfore (gentle Maiſter Wynter) knowing your authoritie and fame in well deſeruyng, and honorable ſeruice vnto your Prince and Countrey, to be ſuche as all men thynke ſo well of, and ſo greatlye eſteeme, to whom (rather then vnto you) may I dedicate this booke of Nauigation? In conſyderation whereof, and the hope that I haue in your approoued curteſie, fauourably to accept this dedication, as proceedyng from one that deſyreth nothyng more then to doo you ſeruice, and remayne in your grace, I ſhall thynke my trauayle wel beſtowed, and ſufficiently recompenced, yf it ſhall pleaſe you to accept the ſame as thankfully, as I wyllyngly offer it vnto you. For yf there be any thyng in me, wherein I maye by good reaſon pleaſe my ſelfe, it is cheefely this, that I haue euer loued and honoured men of ſinguler vertue or qualitie, in what ſoeuer laudable Art or Science, euen of thoſe whereof I mee ſelfe haue litle knowledge, as are Geometrie, Aſtronomie, Architecture, Muſicke, Paynting, feates of Armes, inuentions of Iugens, and ſuche lyke: Of the whiche, this our age maye ſeeme not onely to contende with the Aunciientes, but alſo in many goodly inuentions of Art and wyt, farre to exceede them. For (not to ſpeake agaynſt all the marueylous inuentions of our tyme) what of theirs is to be compared to the Artes of Printyng, makyng of Gunnes, Fyre woorkes, of ſundry kyndes of artificial Fyres, of ſuche marueylous force, that mountaynes of moſte harde rockes and ſtones, are not able to reſyſt their violence, but are by them broken in peeces, and throwen into the ayre with ſuche violence, that neyther the ſpirite of Demogorgon, or the thunderboltes of infernal Pluto can doo the lyke. What ſhoulde I here ſpeake of the woonderfull inuentions of Fartalio, in his booke De Arte maiori? or of many other, wherof Vannucius Beringocius wryteth in his booke, entituled Pyrotechnia. As touchyng which terrible inuentions, and the lyke, although ſome men be of opinion that they were inuented by the inſtigation of the deuyll, for the deſtruction of mankynde: yet other weyghyng the matter more indifferently, thynke that the inuention of Gunnes hath been the ſauyng of many mens lyues, becauſe before the vſe of them, men were not woont ſo long tyme to lye batteryng in the beſiegyng of Townes or Fortreſſes, but in ſhort ſpace to come to hande ſtrokes, and to foughten feeldes, to the great ſlaughter of great multitudes. And ſeeyng that nowe our enimies the Turkes, and other Infidels, haue the vſe of theſe deuylyſhe inuentions (as they name them) it may be thought requiſite for vs, agaynſt ſuche deuylles to vſe alſo the lyke deuylyſhe inuentions, leſt refuſyng the ſame, and geuyng place to euyl, we ſhoulde wyllyngly ſuffer the kyngdome of the deuyll to triumphe ouer vs, not otherwyſe able to reſyſt, and much leſſe to ouercome ſo puiſſant and horrible enimies (except beſyde al hope) myght aryſe in our defence ſome newe Moyſes, or Elias, or the Prieſtes of Iericho, whiche onely with the noyſe and ſounde of Hornes or Trumpettes ouerthrewe the walles of the towne. Neyther wyl the example of Dauid and Goliath, or of Samſon and the Philiſtines, ſerue our turne at this tyme, although I beleeue that the arme of the Lorde is not weakened, yf there lacked not a Moyſes with his rodde, and woorthie Aſſyſtentes, which myght helpe to holde vp his weery arme. But to returne to ſpeake of ingens, and ingenious inuentions, whiche inuented and vſed to the glorie of God, and defence of his people, againſt the furie and tyrannie of Infidelles, they may as woorthyly be called the gyftes of God, as were the inuentions and Art of them that buylded eyther the Temple of Hieruſalem, or the Arke of God: And yet is it there wrytten of thoſe Artificers, that God gaue them the ſpirite of knowledge and cunnyng in ſuche Artes. And therefore I thynke it may alſo be ſayde without offence, that the knowledge of Archimedes, and other men in ſuche commendable inuentions, are the gyftes of God, for as muche as the gyftes of God are free, and not bounde to any nation or perſon. And yf it may be graunted that the ſpirites of men, or the ſpirite of God in men, may be diuided (as was the ſpirite of Moyſes to twelue other) or otherwyſe that the ſpirites of dead men may reuiue in other (after the opinion and tranſanimation of Pythagoras) we may thynke that the ſoule of Archimedes was reuiued in Beſſon, that excellent Geometer of our tyme, whom I knewe in Fraunce the Maiſter of the engins to the Frenche kyng, Charles the nienth, vnder whom that lamentable ſlaughter at Paris was committed, in the whiche were ſlayne ſo many noble men. Whiche crueltie the ſayde Beſſon abhorryng, fled hyther into England, and

Exod.xxxv.
Bezaleel and
Ahaliab.

here dyed, in the yeere. 1573. and left in witneſſe of his excellencie in that Art, a booke in prynt, conteynyng the fourmes and portractes of ſyxtie engins of marueylous ſtrange and profytable deuice, for diuers commodious and neceſſary vſes. Of the whiche, for as muche as three of them, that is to meane, the. 54. 57. and 60. be engines cheefely parteynyng vnto Shyppes, it ſhall not be from my purpoſe here to make a breefe rehearſal of them. The. 54. therefore (as he wryteth) is an engin not vnlyke vnto that whiche in auncient tyme Archimedes inuented for the Syracuſians, wherewith a man with the ſtrength of onely one hande, by helpe of the inſtrument called Triſpaſton (which in our tongue ſome cal an endleſſe Scrue, brought a Shyp of marueylous greatneſſe from the lande into the ſea, in the ſyght of kyng Hieron, and an infinite multitude, whiche with all their force coulde not doo the ſame. &c. Of the which alſo, our countrey man, Roger Bacon, a great Philoſopher (and no Nicromancer, as that ignorant age ſlaundered him) ſeemed to haue had ſome knowledge: For in his booke of the marueylous power of Art and Nature, he maketh mention of an Inſtrument (as farre as I remember) no bygger then a mans hande, wherewith one man myght drawe to hym the ſtrength of three hundred men. And I well remember, that at my beyng in Fraunce, I hearde credible reporte, that the Earle of Rocumdolfe, an Almaine, made an engin, wherewith the ſayde kyng Charles when he was but. xvi. yeeres of age, lyfted from the grounde a weyght, whiche the ſtrongeſt man in the courte was not able to remooue. Almoſte the lyke deuice we ſee in the bendyng of a Croſſebowe. Alſo at my being in Germanie in the citie of Stroſburge, a woorthy and learned Gentleman, Monſieur de Saleno, tolde me that in that citie one had inuented an engin of iron, no bygger then a mans hande, whereunto faſtenyng a rope, with a hooke of iron, and caſtyng the hooke vpon a wal, tree, or other place, where it myght take holde, he coulde with that engin lyft hym ſelfe vp to the wal, or other place. But to returne to the other two engines of Beſson, parteynyng to our purpoſe. Therefore the. 60. fygure (as he there wryteth) is the inuention of an engin, ſcarſely credible, wherewith by ballance and eaſie motion, beyond the order of nature, a Shyp may be ſo framed and gouerned, that in the calme ſea it ſhall mooue forewarde, and in litle wynde haſten the courſe, & in too much wynde temper and moderate the ſame: A thyng woorth the knowledge to a kyng, as he ſayth. Of the thyrd engin, which is the. 57. fygure of his booke, he wryteth thus, An Artifice not yet diuulgate or ſet forth, whiche placed in the pompe of a Shyp, whyther the water hath recourſe, and mooued by the motion of the Shyp, with wheeles and weyghtes, dooth exactly ſhewe what ſpace the Shyp hath gone. &c. By whiche deſcription, ſome doo vnderſtand that the knowledge of the longitude myght ſo be founde, a thyng doubtleſſe greatly to be deſyred, and hytherto not certaynely knowen, although Sebaſtian Cabot on his death bed tolde me that he had the knowledge thereof by diuine reuelation, yet ſo, that he myght not teache any man. But I thinke that the good olde man, in that extreme age, ſomewhat doted, and had not yet euen in the article of death, vtterly ſhaken of all worldlye vayne glorie. As touchyng whiche knowledge of the longitude, to ſpeake a litle more by occaſion nowe geuen, it ſhal not be from the purpoſe, to rehearſe the ſaying of that excellent learned man, Iohannes Fernelius, in his incomparable booke De abditis rerum cauſis, where in the Preface to king Henrie of Fraunce, he writeth in this maner. We haue put our helpyng hande to the Art of Nauigation and Geographie: for by obſeruation of the houres of the Equinoctialles, we haue inuented howe, in what ſo euer region or place of the worlde a man ſhalbe, he may knowe in what longitude it is: which certaynly we haue not taken of the fountaynes of the ancientes, but fyrſte, of all other (as I thynke) haue drawen it of our ryuers, as our

Of this inſtrument, reade the Coſmolabe of Beſson.

Note [illegible]

owne inuention. &c. So that (ſaith he) whiche way ſo euer you turne your eyes, you may ſee that the poſteritie hath not ryotouſly waſted the inheritance of Artes and ſciences, left them by their predeceſſors, but haue greatly encreaſed the ſame, and inuented other: For certaynely, the multitude of thinges incomprehenſible, is infinite, and ſo therfore inuentions muſt needes alſo be infinite, & without ende. And therefore, as touchyng this thing (ſayth he) to ſpeake freely what I thynke, they ſeeme to me to offende as muche, whiche contende that the auncientes haue inuented and comprehended al thynges, as doo they whiche attribute not vnto them the fyrſt inuentions, ſo depryuyng them of theyr ryght poſſeſſion. For whereas nowe by the benefite of almyghtie God (who hath geuen vs his Chriſte, and with hym all good thynges) the lyght of trueth ſhyneth in our vnderſtandyng by godly inſpiration, there is no iuſt cauſe why we ſhoulde in ſuche thynges thinke vs inferior to the auncientes. Of which Argument, who lyſteth may reade more in the ſayde Epiſtle of Pernelius. And for as much as I haue made mention of ſuch inuentions, it ſhal not be from the purpoſe, to deſcribe the goodly inſtrumēt whereof Angelus Policianus in the fourth booke of Epiſtles to Franciſcus Caſa, wryteth in this maner, I haue receyued your Epiſtle, wherein you ſignifie vnto me, that you haue hearde of the ſtrange engine or inſtrument Automaton inuented, and made of late by one Laurence a Florentine: in the which is expreſſed the courſe and motions of the Planettes, comformable and agreeyng with the motions of heauen: And that (for as muche as the reporte thereof is hardly beleeued) you greatly deſyre that I ſhould write vnto you, what certayne knowledge I haue of that thing, wherein I am redie to obey your requeſt. And although nowe it be long ſince I ſawe it, yet as farre as I beare in memorie, I wyll breefely declare the fourme, reaſon, and vſe thereof. And yf the deſcription of it ſhal ſeeme vnto you ſomewhat obſcure, you ſhall not aſcribe it altogeather to my declaration, but partly to the ſubtiltie & nouiltie of the thyng. It is in fourme of a ſquare pyller, ſharpe toward the top, in maner of a Pyramis, of the height of almoſt three cubites: ouer or aboue it, in maner of a couer, is a flat or playne rounde plate of gylted copper, garnyſhed with ſundry colours, on whoſe other part is expreſſed the whole courſe of the Planets, and whoſe dimention or meaſure is ſomewhat ſhorter then a cubite, and is within turned or mooued with certayne litle denticle wheeles, an immouable circle comprehendyng the hygheſt border or margent, and diuided with the ſpaces of xxiiii. houres within it, in the hygheſt turnyng rundel, the twelue ſignes are diſcerned by three degrees. Further, within are ſeene eyght rundels, in maner all of one greatneſſe. Of theſe, two obteyne the myddle poynt, the one faſtened in the other, ſo that the loweſt beyng ſomewhat bygger, repreſenteth the Sunne, and the hygher the Moone. From the Sunne a beame commyng to the circle, ſheweth in it the houres: and in the Zodiacke, the monethes, dayes, and number of degrees, and alſo the true and halfe motion of the Sunne. From the Moone alſo proceedeth a pynne, or wyre, whiche beneathe or downwardes in the border or margent of the greateſt rundell, ſheweth the houres: and paſſyng by the center of the Epicicle of the Moone, and extendyng to the Zodiacke, ſheweth the halfe motion of his Planet. Another alſo ryſyng from thence, and cuttyng the border of the center of the Moone (that is of the Epicicle) ſheweth her true place, whereby are ſeene the ſlowneſſe, ſwyftneſſe, al motions and courſes, coniunctions alſo, and ful Moones. About theſe are ſyxe other rundels: of the whiche, one, whom they call the head and tayle of the Dragon, ſheweth the Eclipſes both of the Sunne and Moone. The other are attributed to the Planets: from euery of whiche, proceede two poyntes, aſſigning the motions (as we haue ſayd) of the Moone: but they alſo goe backwarde, whiche chaunceth not in the Moone, whoſe Eclipſe is mooued contrarywyſe,

An inſtrument in motion agreeyng with the motion of heauen. Anno Dom. 1584.

trarywyſe. And thus the reaſon of coniunctions, departynges, and latitudes, is manifeſt in all. There is alſo an other border lyke vnto a Zodiacke, cutting or diuidyng vpwarde or aboue, thoſe ſyx litle rundels (whereof we haue ſpoken) being the rundels of the Planettes: whereby appeareth the degrees of the Eaſt ſignes, and the ſpaces of the dayes (that is to ſay) at what houre the Sunne riſeth, by the whiche, euery of the Planettes are carried in their rundels or circles by courſe, in the day tyme to the Eaſt, and in the nyght to the Weſt. Agayne contrarywyſe, the greateſt rundel of al, draweth with it al the Planettes, in the nyght to the Eaſt, and in the day to the Weſt, in the ſpace of. 24. houres. Al which, to agree with the motions of heauen, both reaſon and experience doo confyrme: And therfore ought ye not to marueyle, yf theſe thynges ſeeme incredible to many. For (as ſayth the wyſe Prouerbe) fayth is ſlowlye geuen to great thynges, for euen we ſcarſely beleeue our owne eyes, when we ſee ſuche thynges. And therefore, whereas in tyme paſt I read, that ſuche a lyke inſtrument was made by Archimedes, my fayth yet fayled me to geue credite to ſo great an Aucthour, which thyng neuertheleſſe this our Florentine hath perfourmed. The worke doubtleſſe beyng of ſuch excellence, that all prayſe is inferior to it, and can not therfore for the worthyneſſe thereof be otherwyſe prayſed, then to ſay that it paſſeth all prayſe. The Artificer him ſelfe alſo being a man of ſuch integritie of maners, that the ſunne is nothing inferior to the excellencie of his wyt: in ſo much that he may ſeeme a man ſent from heauen, where he learned the makyng of this heauen, by the example of the other. Hytherto Policianus. Of the lyke inſtrument, Roger Bacon alſo maketh mention in his ſayde booke, of the marueylous power of Art and nature, affyrmyng the ſame to be worth a kyngdome to a wyſe man. But for as muche as the ſubiect whiche I haue nowe in hande, is cheefely touchyng inuentions parteinyng to Shyppes, and the Art of Nauigation, I thynke good to ſpeake ſomewhat of the inuention of a certayne Italian wryter, named Leonardo Fiorauanti, who in his booke, entituled, Specchio di ſcientia vniuerſale, doeth greatly glory in the inuention of Shyppes, whiche can not peryſhe eyther on the ſea, or the lande, affyrmyng that the lyke was neuer inuented ſince the creation of the worlde. But I feare me, leſt vayne glorie of diſcourſyng in the Italian tongue, hath cauſed him more then nedes, to commende his owne inuention, as for the moſte parte is the maner of the Italian writers. Therfore committing the iudgement hereof to men of greater experience and knowledge in theſe thynges, I wyl onely tranſlate his wordes, wherby in the booke before named, he deſcribeth the ſayde Shyppe in this maner. Take beames of Fyrre, or Pyne tree, which of their owne nature can neuer goe downe, or ſyncke, or abyde vnder the water, and with theſe beames frame an engine (Machina, yf I may ſo call it) of the length of three ſcore foote, and of the breadth of twentie foote, and of the heyght of ſyxe foote, laying the fyrſte ranke in length, and the other trauerſe, or ouerthwarte, and the thyrde agayne in length, faſhionyng the fore parte lyke vnto other Shyppes, and in lyke maner, bryngyng the poupe or hynder parte to good fourme: then with ſuche irons as apparteyne, bynde it, and ſtrengthen it in ſuche maner that it can not breake. And vpon this frame or fundation buylde your Shypps, of ſuche faſhion as you thynke beſt. &c. It were here too long to rehearſe with what proude wordes and oſtentation he magnifieth this inuention. But whether this frame or engine ſheulde be bylden vpon the keele or bottome of the Shyp, or otherwyſe, I commit it to them of better iudgement, as I haue ſayde. But wheras it may for this tyme ſuffiſe to haue wrytten thus muche of theſe thynges, I wyll make an ende with onely a breefe rehearſal of the inuention and encreaſe of the Art of Nauigation.

Lib. 3. Ca. 18

The inuention of a Shyp which can not be drowned.

After that the Art of Nauigation was founde, euery man began to chalenge vnto hym the dominion of the ſea, & there to dwel and kepe warre euen as on the land. Minos (as wryteth Strabo) was the fyrſt that ruled on the ſea, whiche neuertheleſſe, other aſcribe to Neptunus, who fyrſt founde the Art of Nauigation, and was therefore (as wryteth Diodorus) appoynted by Saturnus to be Admiral of the fyrſte Nauie: and thereby the poſteritie afterwarde aſcribed to him the gouernaunce of the ſea, and named him the God thereof. After whom the Cretenſes euer were eſteemed moſt expert in the Art of Nauigation. But (as wryteth Plinie) boates were fyrſt inuented, and with them was the fyrſte ſaylyng in the Ilandes of the redde ſea, vnder kyng Erythra, as alſo witneſſeth Quintilian, ſaying, If none had proceeded further then the inuentions of our predeceſſors, we had had nothyng in the Poets aboue Andronicus, and nothyng in hiſtories aboue the Annales or Cronicles of Byſhoppes, and had yet haue ſayled in troughes or in boates. Other haue aſcribed this inuention to diuers other nations and perſons, as to the Troians and Myſians in Helleſponto, and alſo that the ancient Britanes made boates of leather or hydes, and ſayled with them in the Ocean ſea. Plinie wryteth, that Danaus was the fyrſt that brought a Shyppe out of Grece into Egypt. Some alſo geue the ſame to Minerua. But moſt ryghtfully, the inuention both of the Shyp, and Art of Nauigation, is aſcribed to Noe, who (as wryteth Euſebius) was long before Neptune or Danaus. For doubteleſſe (ſayth he) the Arke of Noe was none other then a Shyp, and the fyrſte and onely exemplar of the buyldyng of all other Shyppes or veſſelles of ſaylyng. Alſo the moſte ancient wryter Beroſus the Chaldean (as wryteth Ioſephus) calleth the Arke of Noe, a Shyp. The ſame Ioſephus alſo ſayth, that the Nephues of Noe, departyng to inhabite diuers partes of the worlde, vſed many Shyppes. &c. Long after Noe, the Tyrians were counted moſt expert in the Art of Nauigation: and after them, diuers other nations. For wheras no Art is ſo perfect, but may receyue encreaſe, hereof doth it folowe, that this Art alſo hath been greatly augmented, and brought to further perfection by witty inuentions of the poſteritie, euen vnto our age: wherof, who ſo lyſteth to knowe further more particulerly who inuented all other partes and inſtrumentes parteynyng to al ſortes of Shyppes, & Art of Nauigation, may reade ẏ thyrde booke of Polidor Virgil, Cap. xv, De Inuentorib. Rer. and Bayſius, de re nauali.

Thus gentle Maiſter Wynter, beſeechyng your worſhyp to take in good part this teſtimonie of my thankfull hart (suche as it is) I beſeeche the immortall God to proſper all your dooinges to his honor, and the benefite of your Countrey.

(*.*)

¶To the right Reuerende father in *Chriſte, and honorable Prince, Lorde* Iohn Gebhard, of the Earles of Mansfelt. &c. Archbiſhop of Colen, Prince elector, duke of Angaria and VVeſtphalia, hygh Chaunceler of the Romayne Empire. &c.

THE *thing which to this day in maner from the beginning of the world, great Philoſophers with perpetual ſtudie and great labour, haue endeuoured to bring to effect, and deſired ende (moſt gratious Prince) hath neuertheleſſe hitherto remayned eyther vnknowen, or hydde, not without great damage and hynderance of moſte expert Mathematicians and Architectours, and al other men of lyke practicall faculties: And yf any there haue been whiche haue attayned to the experience of this continuall motion, I ſuppoſe the ſame to haue been vexed and noted, with the vayne glorye of the incomparable paynter and grauer,* Michael Angelo, *who euen at the extreme rendryng of the ſpirit of lyfe, dyd not vouchſafe to diſcloſe vnto his owne ſonne the ſecrets of his arte, eſteeming it greatly to the reputation of his fame and glory, by this ingrate hydyng of his ſcience, falſely to obteyne a perpetual memorie with ſuche as ſhoulde ſucceede hym: Or els truely he doubted (as is commonly ſeene in all maner of doctrine and ſcience) that there ſhoulde ſtill ryſe vp certayne malitious and enuious quarrelers, and troublous wits, inſtigate by an euyl ſpirite, to deface and ſuppreſſe trueth with ſlaunderous tongues, eſpecially agaynſt artes Mathematikes (of whiche kinde, are Grauyng, Payntyng, and ſuche lyke) whiche in al ages haue euer been ſubiect to this inconuenience of ignorant detractours, except they be defended by the protection and title of fauourable princes. And whereas ſuche ſciences*

A perpetual or continuall motion.

Michael Angelo.

vnto the ignorant ſeeme ridiculus and ſuſpicious, neuertheleſſe in the frame and experience of this continuall motion, ought no ſuſpicion to be had. And foraſmuche as the ſame is very neceſſarie and profitable for the common wealth, I was the bolder through confidence in your hyghnes clemencie vnder the grace and title of the ſame, to put foorth this litle booke of continuall motion. The whiche howe great profite and exerciſe it may bryng to excellent men of what ſo euer facultie, experience it ſelfe ſhal eaſily declare. Moſt humbly deſiring your highneſſe, gratiouſly to accept this ray trauaille with ſuch as are conſecrate to the Muſes, and employ theyr labours to the profite of mankinde.

(.·.)

Your hyghneſſe moſte humble
ſeruant and Oratour, *Iohn Taiſnier Hannonius.*

¶Of the nature and effectes of the Lode ſtone, called in Latine *Magnes.*

It is a common prouerbe that in ſtones, woodes, and hearbes, conſyſteth great vertue: which ſaying is doubtleſſe moſt manifeſt by the dayly experience of this ſtone, beyng founde in ſundry places of India, it is ſayde alſo that it was founde in Spayne by one named Heracleon (as witneſſeth Nicander) whyle in keepyng of cattell, the iron nayles of his ſhowes and pyke of his ſtaffe, cleft faſt to the ſtone. Of the which Magnes, are fiue kinds as Sotacus wryteth. That is to wyt: one of Ethiopia. An other of Macedonia. The thyrde is founde in Echio of Beotia. The fourth about Troades of Alexandria. The fyfth of Magneſia Aſiæ. The difference of the ſtone is, whether it be male or female. The next difference, is in colour: for that which is founde in Macedonia and Magneſia, is ruddiſhe and blacke. That of Beotia, is more ruddiſh thē blacke. That of Troades is blacke, and of female kinde, and therefore without vertue. The worſt of Magneſia Aſiæ, is whyte, and draweth not iron, and is lyke vnto a pumice ſtone. They are proued the beſt which are moſt of blewe or heauenly colour. That of Ethiope is moſt prayſed, and (as Plinie ſayth) is ſolde for the weight of ſiluer. This is found in Zimri, a ſandie region of Ethiope, where is alſo founde Hæmatites Magnes, of blooddy colour, appearyng lyke blood yf it be grounde, and alſo lyke ſaffron, whiche in drawyng of iron, is not of like vertue to the Hematites Magnes of Ethiopia, whiche draweth vnto it another Magnes. All theſe be profitable for medicines of the eyes, eche of them accordyng to their portion, and do ſpecially ſtay Epiphoras (that is) droppyng of the eyes. And alſo beyng brunt or made in powder, they heale burninges. And not farre from the ſame place of Ethiopia, is a mountayne

Fiue kindes of Lode ſtones.

Lodeſtone male and female.

The beſt Lode ſtone of blewe colour.

Lode ſtone ſold for the weight of ſiluer.

One lode ſtone draweth another.

Lode ſtones medicinable for the eyes.

whiche

The ſtone Theamedes putteth iron from it.

Iron nayles drawen out of Shippes by the ſtone.

whiche bryngeth forth the ſtone called Theamedes, which putteth from it, and refuſeth iron. I haue often prooued the vertue and power of the ſtone Magnes, by the needle whiche is in ſome Dialles, by the attraction thereof, moouyng it ſelfe from ſyde to ſyde, and rounde about. Although the ſtone were vnder a table, yet dooeth the needle, being aboue the table, naturally folow the moouyng of the ſtone. It is therfore no marueyle yf there be great vertue in ſtones, woodes, and herbes. It hath alſo been prooued, that Shyppes compact with iron nayles, ſaylyng by the ſea of Ethiope, and by tempeſt dryuen to lande, to certayne capes or landes endes, haue by theſe ſtones been eyther drawen to the bottome of the ſea, or els the nayles beyng drawen out by the vertue of the ſtone, the Shyp hath fallen in a thouſande peeces. And therefore the diſcreete and ware Cantabrians, moſt expert Mariners, ſaylyng by the ſea of Ethiope, frame their Shyppes with pynnes and hoopes of wood, to auoyde the danger that myght chaunce of lyke occaſion.

Agayne, of the naure, knowledge, vertue, equalitie, qualitie, and effectes of the ſtone Magnes, or the Lode ſtone.

Art in manye thyngs paſſeth and amendeth nature.

FOR as muche as euery thing that is good, is ſo muche the better as it is more common: therefore doo I intende to communicate vnto our poſteritie, this litle woorke of the nature, effects and miracles of the ſtone Magnes. The whiche, although they may ſeeme to the ignoraunt common people, to exceede the limittes of nature, yet to expert men, and Mathematitians, they ſeeme not ſo ſtrange, notwithſtandyng that it is almoſt impoſſible to manyfeſt al the ſecrets and miracles therof: For whereas Art inuenteth, and bryngeth to perfection many thynges whiche are impoſſible to nature, it is neceſſary that he who deſyreth to doo great effectes in theſe thinges, and the lyke, be very expert in woorkyng with the hande: neyther is it ſufficient for him to be a perfect Naturaliſt, Mathematitian, or Aſtronomer, for as muche as furthermore is requyred great dexteritie of handie woorke: And for defaulte hereof, it commeth to paſſe, that in this our age theſe natural artes lie hid & vnknowen.

This ſtone is knowen by colour, vertue, weyght, and equalitie. The beſt colour, is lyke pure iron, ſhynyng, mixt with Indian or heauenly colour, & is in maner like iron pooliſhed. This ſtone is alſo oftentymes found in certayne regions of the North, & is brought from thence into certayne partes of Normandie and Flaunders. The experience of the vertue of this ſtone, is eaſie. For if it drawe vnto it a great weyght of iron, it is iudged to be ſtronge: & the heauier alſo the better. By equalitie, it is iudged yf it be al alyke of one ſubſtance and colour: but yf it be vnequall with chappes, & holow places indented, hauyng red ſpottes here and there, it is vnapt to the art of nauigation or of continual motion. It repreſenteth the ſimilitude of heauen. For lyke as in heauē are two poynts immoueable, ending the axiltre of the ſphere, vpon the which the whole frame of heauen is turned (as may be founde by the arte wherby Criſtall & other ſtones are pooliſhed:) euen ſo the ſtone Magnes, reduced into a globous or rounde forme, laying thereon a needle or any other lyke iron, then which way ſo euer the needle turneth and reſteth, thereby is ſhewed the place of the poles. And that this may be done more certaynely, it muſt be oftentymes attempted, and the lyne ſhewed by the needle, muſt be obſerued: for ſuch lynes ſhal cut the one the other in two pointes, as the Meridian circles ioyne togeather in the poles of the worlde.

The ſtone Magnes is knowen by colour, vertue, weyght, and equalitie.

Colour.

Vertue.

Equalitie.

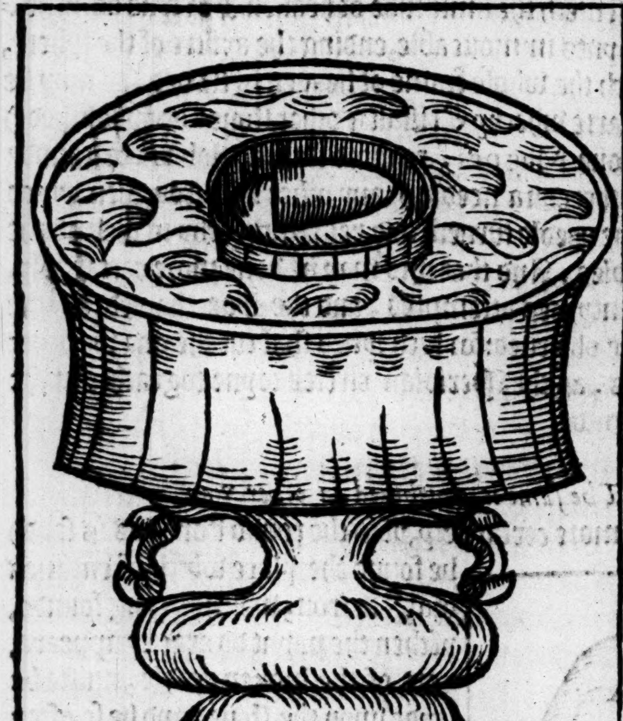
Howe to finde the poles by the ſtone.

The ſame is geathered an other way.

This is done more certaynely, yf in the round ſtone (as is ſayd) be found the place which oftentimes draweth iron, whiche beyng founde, yf then the poynt do exactly appeare, part of the broken needle, muſt be layde vpon the ſtone, and be ſo often by litle and litle tranſpoſed, vntyll the ſtyle or pyn by perpendicle or plommet do directly fal vpon yͤ ſtone. For there on the contrary parte, by lyke maner ſhalbe found the other pole. A. ſhalbe the true point, and B. the falſe.

The maner to knowe the one pole from the other.

Whiche of the two poyntes aforeſayde may anſweare to the pole Artike or the North pole, is founde in this maner. Cauſe a large veſſell to be fylled with water, in the which cauſe the ſtone Magnes to be layde vppon a lyght boorde, not deepe, muche lyke the coueryng of a boxe, ſo neuertheleſſe that the two poyntes founde in the ſtone may lye equally eleuate in the ſayd boxe: and ſo by vertue of ỹ ſtone, the boxe ſhalbe moued to ỹ place where the meridionall pole ſhall extēde toward the South, & the other oppoſite to the North, & ſhal reſt ther. And thus ſhal it be eaſye to diſcerne, whiche of the poyntes anſwereth to the pole Artike, & to the pole Antartike, ſo that the places of heauen be fyrſte knowen by anye meanes.



That

That one ſtone draweth another.

How one ſtone draweth another, we wil declare hereafter. Lay ẏ one (as is ſayd) vpon a boorde or boxe in the water, that it may freely flote, ⁊ hold an other in your hande. If then the North part of the ſtone, whiche you holde in your hande, you turne to the South parte of that whiche floteth in the boxe, or otherwiſe the South part to the North, the floting ſtone ſhall turne toward your hand: and yf contrarywyſe, you turne the lyke part to his lyke, that is to ſay, the South part to the South &c. the flotyng ſtone ſhal flye from you. By this experience is deſtroyed the reaſon of certayne Phiſitions, which diſpute on this maner. If Scammonea drawe vnto it choler by ſimilitude or lykeneſſe of nature, ergo muche more ſhoulde one Magnes draw another, rather then iron: for that which they aſſume falſely, we haue nowe taught to be true. The lyke iudgement is of a longe ſlender iron that is rubbed with this ſtone: for yf in the water it be layde on a lyght peece of wood, or a ſtrawe, or ſuch lyke, ſo that it may freely flote vpon the water, the one ende of it ſhall turne to the North, and the other to the South. And yf holdyng the ſtone in your hand, you turne his North poynt to the South extremitie or end, or contrarywiſe, the ſtone ſhal then draw iron. But contrarily, if you turne the lyke part to the lyke (as is aforeſayd) it ſhall flye from the iron, or dryue it away. The reaſon wherof ſeemeth to be, that the agent doth not onely endeuour to make the patient lyke vnto it ſelfe, but alſo in ſuch ſort to vnite it with him ſelfe, yͭ of them two be made one, as may appeare by this reaſō. Take the ſtone Magnes A D. of the which A ſignifieth the North poynt, and D. the South. Diuide the ſtone in two parts A B. and C D. put A B. to the water as is ſayde, and by this meanes you ſhall ſee A. turne to the North, and B. to the South. For the

A queſtion of attraction of humours. &c.

Scammonea, and choler.

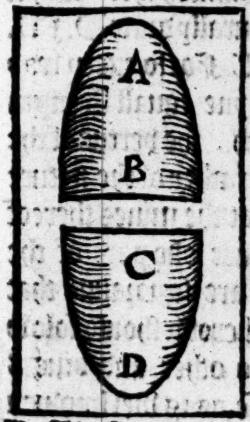
A wire or a needle.

How the ſtone draweth iron or driueth it away.

Agent and patient.

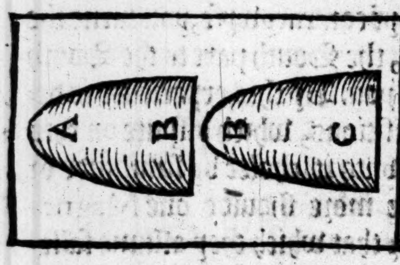
The ſtone diuided in the myddeſt.

A. The North part.



D. The South part.

breakyng or diuidyng of the ſtone, diminiſh not the vertue thereof, ſo that it be Homogenie, yͭ is, in all partes alike. Take therfore A B. for the patient, and C D. for the agent. Then wheras the agent, in the beſt maner it may, woorketh to conſerue the order of nature, it is manifeſt that D. can not drawe C. the South: For although they coulde by that meanes be ioyned, yet ſhoulde there not ſo be made one of them two, the partes remaynyng in theyr vertue: for yf A. ſhoulde remayne North, then D. ſhoulde be South, whiche is certayne to haue the powre of the North,



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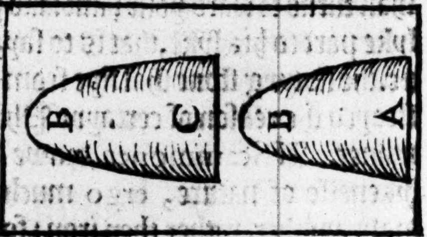

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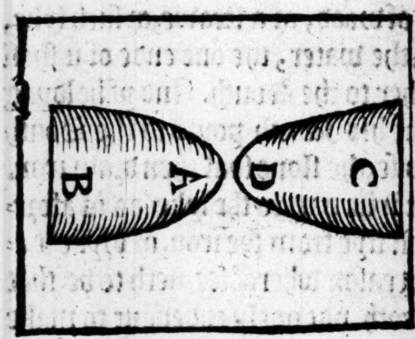


Naturall.

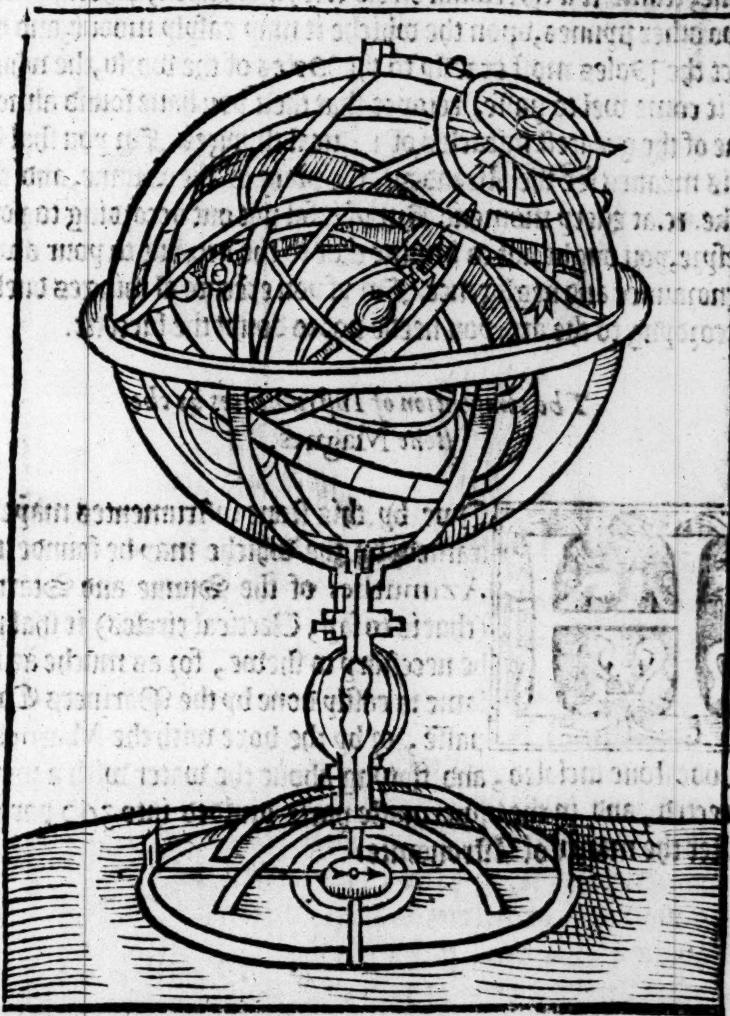
Neyther contrariwyſe ſhal C. drawe A. for both are Northly, and ſo ſhould B. be the North whiche fyrſte was South, and D. in lyke maner: for ſo ſhould the order of nature be inuerted. It remaineth therfore that A ſhal naturally drawe D. & B. ſhal drawe C. For ſo euery way ſhall remayne equall ſtrength of al.

From whence the ſtone hath his vertue.

Some ignorant men were of opinion that the vertue of the ſtone Magnes, commeth not of heauen, but rather of the nature of the place where it is engendred, ſaying that the mines thereof are founde in the North, and that therefore euer one part of the ſtone extendeth towarde North. But theſe are ignoraunt that this ſtone is alſo founde in other places. Wherof it ſhould folow that it ſhoulde then extende it ſelfe aſwell to other and diuers partes, as to the North. Which thing is falſe, as is wel knowen by common experience, for it euer moueth to the North in what ſo euer place it be. Neyther is it to be beleeued, that the North ſtarre of the Mariners is the Pole: for as muche as that ſtarre is without the Meridian lyne, and but twyſe within one reuolution of the fyrmament. But whereas the marueylous vertue of this ſtone dependeth of heauen, who would beleue that only two poyntes thereof ſhoulde ſo haue them ſelues, and not rather that euery parte of it ſhould not enclyne to ſome lyke part in heauen, as may thus be prooued. Let the ſtone be brought into a Sphe-

The North ſtarre is not the Pole.

Euery part of this ſtone reſpecteth ſome part of heauen

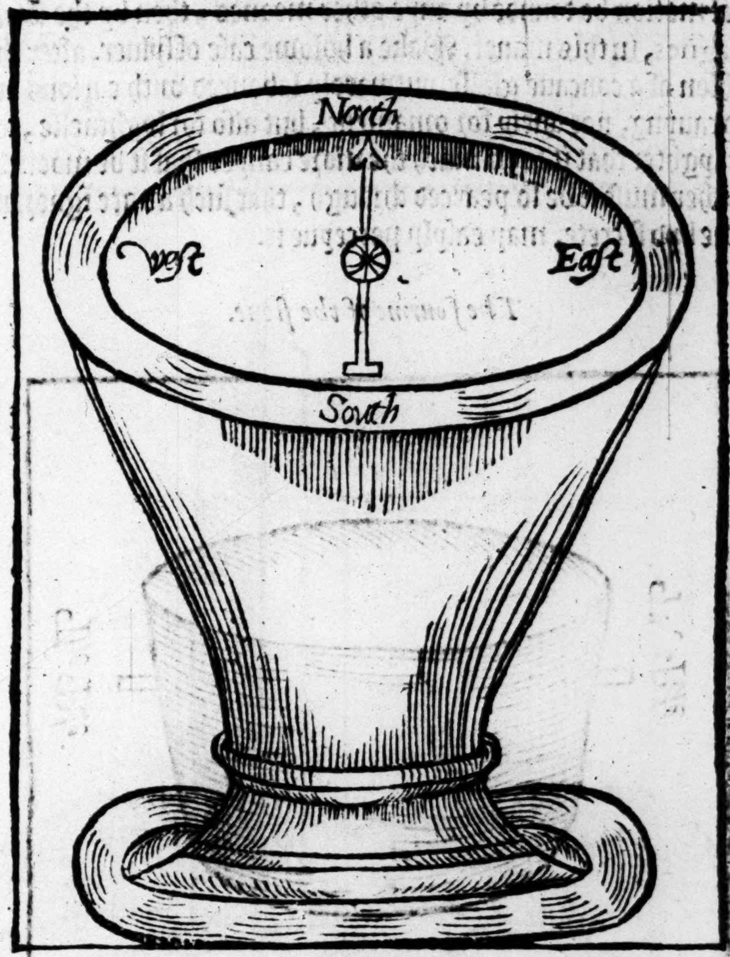


The greateſt miracle in naturall thinges.

rical or rounde fourme, as is ſayde, and the Poles being founde in maner before declared, let it be turned vppon two pynnes, or Turners inſtruments, and there be pullyſhed, vntyl it be on euery parte of equall heauyneſſe, which you may wel fynde by often prouyng: for that parte that falleth downe is heauieſt, whiche done, frame it a Meridian circle with a Horizon, wherin faſten two other pynnes, vpon the whiche it may eaſyly mooue, and direct the Poles moſt exactly to the Poles of the world, the which yf it come wel to paſſe, reioyce that then you haue found almoſt one of the greateſt miracles of natural thynges. For you ſhal by this meanes ſee the Aſcendent, the place of the Sunne, and the lyke. &c. at euery moment. But yf it fal not out accordyng to your deſyre, you ought not to impute that to the art, but to your owne ignoraunce and negligence. For yf you execute al thinges duely, accordyng to the art, you neede not to doubt the ſucceſſe.

The compoſition of Inſtrumentes by the ſtone Magnes.

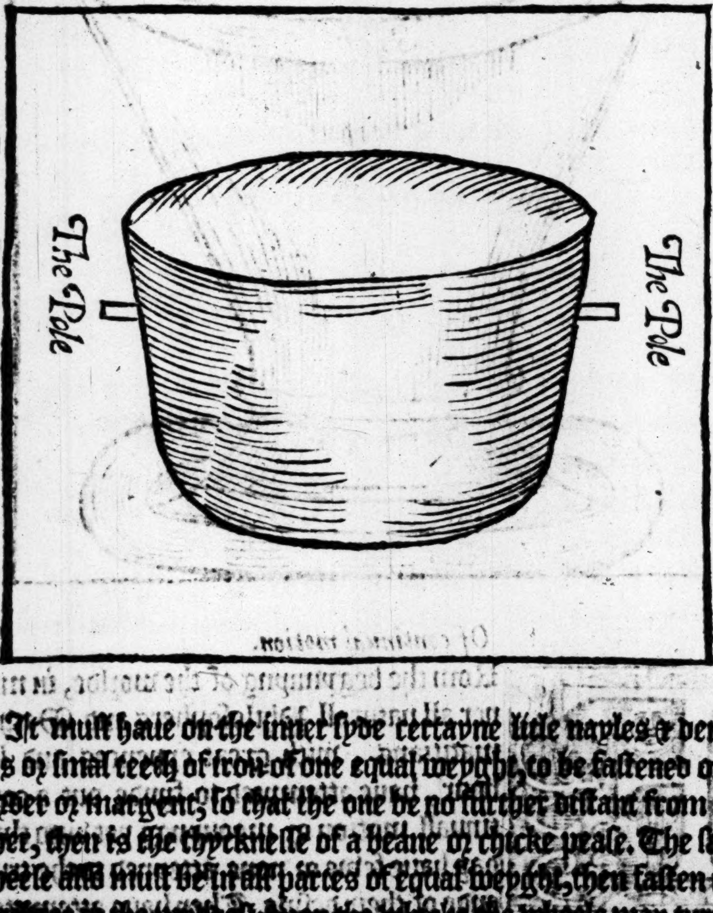
HOwe by this ſtone inſtrumentes maye be framed, by the whiche may be founde the Azimuthes of the Sunne and Starres (that is to ſay, Vertical circles) it ſhal not be neceſſary to ſhewe, for as muche as the ſame is eaſily done by the Mariners Compaſſe, or by the boxe with the Magnes or Lode ſtone incloſed, and flotyng aboue the water with a pynne erected, and in the vppermoſte parte diuided into 360 partes, after the maner of Aſtronomie.



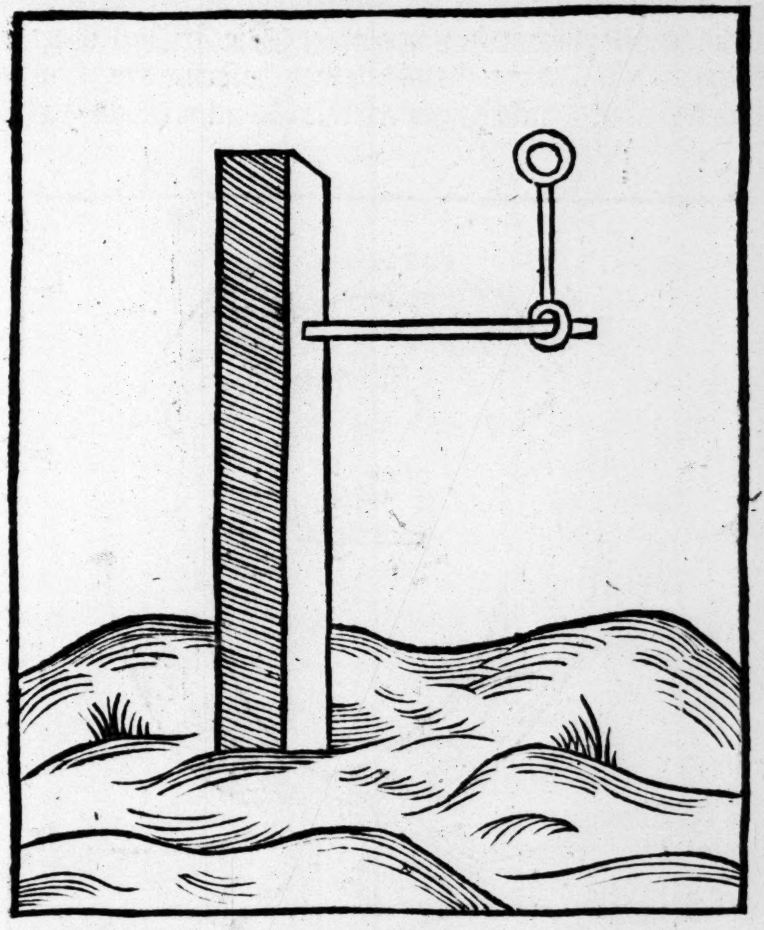
Of continual motion.

FRom the begynnyng of the worlde, in maner all naturall Philoſophers and Mathematitians, with great expences and labour, haue attempted to fynde out a continuall motion or mouyng: yet vnto this day haue fewe or none atteyned to the true ende of their deſyre. They haue attempted to doo this with diuers inſtrumentes & wheeles, and with quickſyluer, not knowyng the vertue of this ſtone. Neyther can continual motion be founde by anye other meanes, then by the ſtone Magnes, in this maner. Make a holowe caſe of ſyluer, after the faſhion of a concaue glaſſe, outwardly laboured with curious art of grauyng, not onely for ornament, but alſo for lyghtneſſe, for the lyghter that it is, ſo much the more eaſlyer ſhal it be mooued, neyther muſt it be ſo pearced through, that ſuch as are ignorant of the hyd ſecrete, may eaſyly perceyue it.

The fourme of the ſtone.



It muſt haue on the inner ſyde certayne litle nayles & denticles or ſmal teeth of iron of one equal weyght, to be faſtened on ẏ border or margent, ſo that the one be no further diſtant from the other, then is the thyckneſſe of a beane or chicke peaſe. The ſayd wheele alſo muſt be in all partes of equal weyght, then faſten the Exiltree in the myddeſt, vpon the whiche the wheele may turne, the Exiltree remaynyng vtterly immoueable. To the whiche Exiltree agayne ſhalbe ioyned a pynne of ſyluer, faſtened to the ſame, and placed betweene the two caſes in the hygheſt parte, whereon place the ſtone Magnes. Beyng thus prepared, let it be fyrſte brought to a rounde fourme, then (as is ſayd) let the Poles be founde: then the Poles vntouched, the two contrarye

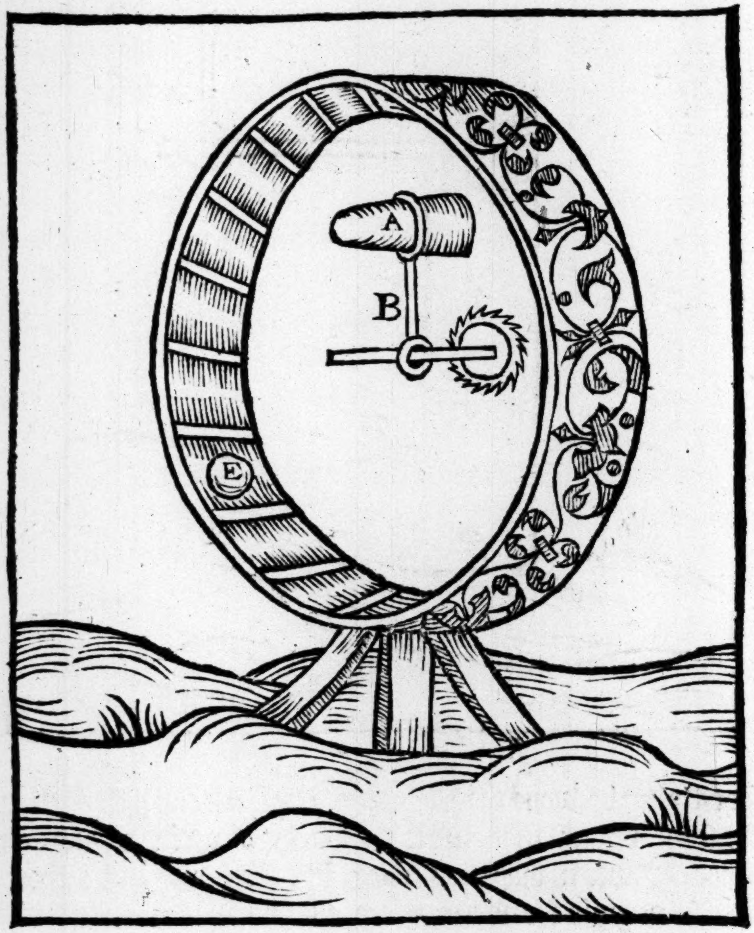


ſydes lying betwene the Poles, muſt be fyled and pullyſhed, and the ſtone brought in maner to the fourme of an egge, and ſomewhat narower in thoſe two ſydes, leſt the lower parte thereof ſhoulde occupie the inferior place, that it may touche the walles of the caſe lyke a litle wheele. This done, place the ſtone vpon the pynne, as a ſtone is faſtened in a ryng, with ſuche art, that the North Pole may a litle enclyne toward the denticles, to the

Denticles be litle teethe, or pynnes about the wheele, that it maye the eaſier turne about.

ende that the vertue thereof woorke not directly his impreſſion; but with a certayne inclination geue his influence vpon the denticles of iron. Euery denticle therfore ſhall come to the North Pole, and when by force of the wheele it ſhall ſomewhat paſſe that Pole, it ſhall come to the South part, whiche ſhall dryue it backe agayne: whom then agayne the Pole Artike ſhall drawe as appeareth. And that the wheele may the ſooner doo his office within the caſes, incloſe therein a litle Calculus (that is) a litle rounde ſtone or pellet of copper or ſyluer, of ſuche quantitie, that it may commodiouſly be receyued within any of the denticles:

Calculus, a litle rounde ſtone or ſmall weyght lyke a pellet or plommet.



A. The ſtone.

B. The ſiluer pinne.

E. Calculus.

then when the wheeles ſhalbe rayſed vp, the pellet or rounde weyght ſhall fal on the contrary parte. And whereas the motion of the wheele downewarde to the loweſt part, is perpetuall, and the fall of the pellet, oppoſite or contrary, euer receyued within any two of the denticles, the motion ſhalbe perpetuall, becauſe the weyght of the wheele and pellet euer enclyneth to the centre of the earth, and loweſt place. Therfore when it ſhal permit the denticles to reſt about the ſtone, then ſhall it well ſerue to the purpoſe. The myddle places within the denticles ought ſo artificially to be made holowe, that they may aptly receiue the fallyng pellet or plommet, as the fygure aboue declareth. And briefly to haue wrytten thus much of continual motion, may ſuffice.

(.)

Of moſt ſwift Motion by *arte of Nauigation.*

WE intende nowe to ſpeake of moſte ſwyft motion, which to the cōmon ſorte of men ſeemeeth incredible, for that the ſame maye be doone by ſaylyng in a ſhyp or other veſſell, agaynſt what ſo euer moſte outragious courſe of any fludde or ryuer, and agaynſt moſt furious wyndes what ſo euer they be, euen alſo in deepeſt wynter and greateſt ſourges of waters. Neyther is it marueyle yf this be incredible to the vnexpert. For the common people counteth that for a miracle, which the expert Mathematitians knowe to be naturall and eaſie: for yf it ſhoulde be propounded to the ignoraunt people, that anye man myght in the myddeſt of the waters and fluddes, deſcende to the bottome of the ryuer of Rene, his apparel remaynyng drye, & no part of his body wette, & alſo to bryng with hym burnyng fire from the bottome of the water, it ſhoulde ſeeme to them a laughing ſtocke, a mockerie, and impoſſible. Whiche neuertheleſſe in the yeere 1538. in Toleto a citie of Spayne, in the moſt ſwyft riuer Tagus (in the whiche golde is founde) runnyng agaynſt the courſe of the Sunne none otherwyſe then Danubius, and three other in the world, makyng theyr courſe from the weſt to the Eaſt, I, with twelue thouſand other perſons, ſaw in the preſence of Charles the Emperour the fyfth of that name. Of ſuch other marueylous naturall experimentes, I neede not here to ſpeake muche. Other there be that dare affirme, that a certaine ſhip was in ſuch ſort dryuen with violent wyndes and furious ſeas with ſo ſwyfte a courſe, that the Pilote ſtandyng in the keele of the ſhyp, neare vnto the maſt, ſhootyng an arrowe out of a croſſe bowe, the arrowe fel downe before his feete, and came not ſo farre as to the forepart or forecaſtle of the ſhyp. I haue hearde alſo of credible

men,

A ſtrang experiment practiſed.

The ryuers of Tagus & Danubius.

Marueylous ſwiftneſſe of a ſhyp.

men,that a certayne Pilote Cantabrian, lying at anker at Antwerpe, on a certayne Sunday after mornyng prayer, departed with full ſayles and proſperous wyndes, vntyll he came to the coaſt of Saint Iames in Compoſtella. And immediately returnyng with lyke proſperous wyndes, came agayne to Antwerpe in the ſame ſhyp the Sunday next folowyng. The whiche I denye not,but may be done,yet not without great daunger of ſhipwracke,eſpecially in the returne,the winde beyng at the South. Alſo in the yeere.1551. I had experience of a moſt ſwyft motion. For, from Drepan of Sicilia and Trinacria, the porte of the galles of Maltha(nowe being in place of the Rhodes,otherwyſe called of Saint Iohn in Ieruſalem) a certayne ſhyp without euer ſtrykyng ſayle,in.37.houres arryued at Naples. And yet are theſe places diſtant in latitude almoſt fyue degrees, beſyde ſome part of longitude: whiche on the earth correſpondeth or amounteth to foure hundred and fyue myles. Theſe motions, are cauſed by violent fluddes and outragious wyndes. The lyke alſo may be doone agaynſt the furie of wyndes and violence of fluddes, when neede ſhalbe for expedite cariage of vitayles by ſea,and euen in places where it is harde to come to lande, and this with ſmall labour, as hereafter I wyll playnely declare by Demonſtration: but oftentymes, moſt expert Pilotes and ſea men,do marueyle that ſaylyng in ſhyppes of the ſelfe ſame makyng,weyght,content,or capacitie,framed alſo of the ſelfe ſame ſhypwryght, furniſhed with equall ſayles,and all other thynges apparteining,yet to be of ſuch diuers ſwiftneſſe,that the one can not kepe equal courſe with the other. Which marueiling doubtleſſe proceedeth of ignorance and lacke of knowledge of the due proportion of the frame of al ſortes of ſhippes: that is to meane, the deapth,breadth,heyght,and length (named by the maiſters, latitude,longitude,altitude,and profunditie.) The which yf they be vnknowen to the maiſter Carpenter or Shypwryght, two ſhyppes can neuer be ſo directed by equall courſe, but that one ſhalbe ſwyfter then another, as I playnely obſerued in the expeditions of Arſenaria,or Thunes,or Agolette: in which amongſt in maner innumerable ſhyppes, and eſpecially Galleys, and

Swyfte ſpeede after mornyng prayer.

An other experience of ſwift ſaylyng.

The differēce of ſhyppes in ſaylyng.

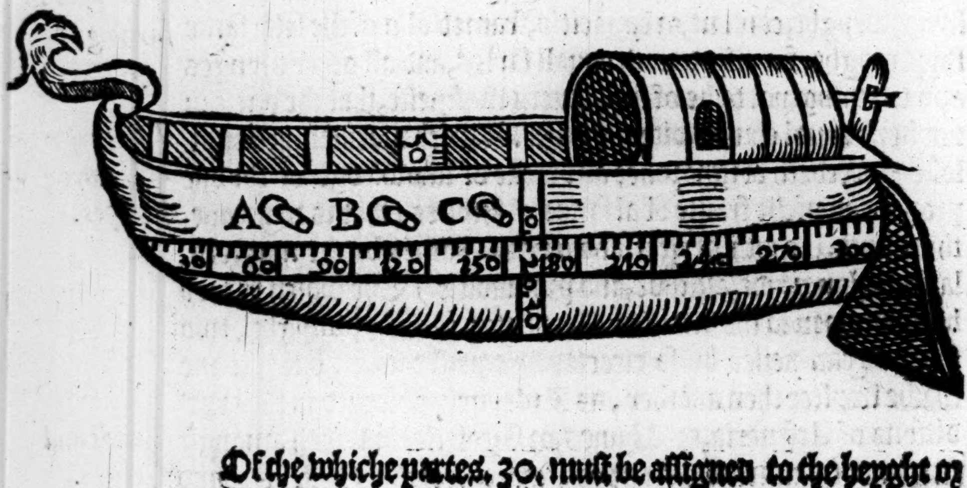
The proportiō in framyng of ſhyppes.

Tunes and Goletto.

foyſtes, were ſcarſely two or one of the ſame quantitie, heauyneſſe, greatneſſe, and capacitie, dryuen all with one wynde and equall ſayles, that kept equall courſe one with another: And this doubtleſſe onely by reaſon of the different proportion of the framyng, makyng, or architecture.

Of the ryght and due proportion of what ſo euer Shyppe.

IN the framyng of any maner of ſhyppe, the proportion of length, breadth, heyght, and deapth, ought moſt cheefely to be exactly obſerued, leſt the ignorance and negligence of theſe conſyderations, ſhoulde hynder the ſwyfte courſe, and cauſe daunger of ſhypwracke. The due proportion therefore of ſhyppes is, that fyrſte the longitude or length of the ſhyppe or veſſell what ſo euer it be, more or leſſe, ought to be diuided into. 300. equall partes, as appeareth in the figure folowyng.



Of the whiche partes. 30. muſt be aſſigned to the heyght or depth, for the tenth part of yͤ whole requiſite longitude or length: and to the latitude or breadth ſhall correſponde the partes of the ſayde longitude.50.or the ſyxth part of the longitude. The matter alſo or tymber of the Shyp muſt be lyght, leſt too muche heauyneſſe of the matter ſhoulde hynder the ſwyfte courſe. And this proportion of Shyppes or other ſaylyng veſſelles, of whatſoeuer ſhape or frame, is moſt conuenient, and no leſſe neceſſary: As for Scafes, Shyppes of burden, Galleis, double, triple, or quadruple (that is to ſay) of two, three, or foure men to an Ore. Alſo for Foyſtes, Pinaces, Brigantines, Eſpions, and ſuche lyke.

Of the framyng and Architecture of the aforeſayde Shyp.

I HAUE often tymes attempted by Mathematical reaſon, howe and in what maner a commodious faſhion of Shyppes, or other lyke veſſelles may be inuented with ſmal labour and litle coſt, which may in ſhort tyme ſtryue againſt yͤ courſe of whatſoeuer ſtrong fluddes or ryuers, as Rhene, Danubie, Moſella, Scalda, and almoſt infinite ſuche other, boylyng and ouerflowyng, through the abundance of great ſhowres, molten ſnowes, and furious wyndes, and this eſpecially for the commoditie of tranſportyng victualles, and ſuche other neceſſaries: In conſyderation wherof, the proportion fyrſt obſerued, and the ſayde Shyp or veſſell almoſte finiſhed, then muſt be made three holes from the Kele, towarde the forecaſtle or foremoſte part of the Shyp, as appeareth in the fygure by the letters A B C. In which holes, in tyme of the courſe, certayne engines of ſtrange and marueylous inuentions may be faſtened. In the poupe or hynder parte of the Shyp, maye be prepared (after the maner of Germanie) a litle Stoue or whotte houſe, where the Paſſengers maye commodiouſly reſt. Nowe the Shyp beyng thus prepared, the bottome thereof muſt be dreſſed with tallowe, and not with tarre, that it may mooue the ſwyftlyer.

Thus hauyng abſolued the frame and proportion of the ſayde Shypp, the reſt of Mechanicall or handicrafte worke, we leaue to the Carpenters and Shypwryghtes.

To what vſe ſuche kinde of Shyppes or veſſelles may be applyed.

IT chaunceth often tymes, and eſpecially in winter, that certayne floods and riuers ouerflowen with to much abundance of waters, doo with their violence refuſe all nauigations that may be made agaynſt their courſe, to the great domage and hurt of the Inhabitantes of many Townes and Cities, to the whiche they ſhoulde carrie victualles, and other prouiſions, agaynſt the courſe of the ryuers: And therefore in fauour of the common wealth, I haue inuented theſe kynde of Shyppes, that I may hereby, as by my ſeale, confyrme the good wyll I beare to our poſteritie. Nowe therefore it may ſuffice to haue ſayde thus muche of this ſwyfte motion whiche I haue prooued with myne owne ſtrength, and haue ſufficiently declared the framyng and vſe thereof: whereunto it ſhalbe eaſye for all men to adde more, accordyng to the excellencie of their wyttes and experience. For in all ſciences it is eaſyer to adde to inuentions, then to inuent. Conſyder nowe what commoditie this may bryng to the Brabantines, ſaylyng from Antwerpe to Bruxels in the newe ryuer: For that which they attempt dangerouſly with great vexation and ſhoggyng in waggons by foule and tedious iourney, often wette to the ſkyn for the ſpace of one whole day, maye by water be doone more conueniently, in the ſpace of foure or fyue houres, euen agaynſt the ryuer and wynde.

It is eaſier to adde to inuentions, then to inuent.

The newe ryuer from Antwerpe to Bruxels.

And leſte the reader ſhoulde ſeeme to refute our ſayinges, whyle he thynketh thoſe thynges whiche he eſteemeth for miracles, to exceede the limittes of nature, I wyll ſhewe manifeſtly by one Demonſtration, howe a man may deſcende into the bottome of anye water or ryuer, his body remaynyng drye, as here before I haue affirmed, that I ſawe in the famous Towne and kyngdome of Toleto, before the Emperour Charles the fyfth, and infinite other. But here muſte fyrſte be conſydered, that naturally the water or ſea (as other Elementes) intendeth to Sphericall forme, and with his globoſite or ryſing, ouerpaſſeth moſte hygh mountaynes. But agayne here ſhall ryſe an other doubt to the vnexpert. That is: If the ſea be hygher then the lande, howe is it then that it dooth not drowne and couer the earth? Whereunto I aunſweare, that the dryeneſſe of the earth maye ſo long reſyſte the moyſteneſſe of the water, vntyll it receiue or imbibe to muche moyſteneſſe, whiche may thus be naturally prooued. Fyll a cuppe or other veſſell with water or wyne to the brymme, ſo that the fulneſſe thereof maye ſeeme to ſwell as though it woulde ouerflowe the brymme of the cuppe. Then may you yet put therein many peeces of golde, without ſheddyng of one droppe of water. But yf the extremitie of the brymme be once wette, immediately the water ouerfloweth, becauſe the dryeneſſe of the veſſell dooth participate the moyſteneſſe of the water: whiche is yet better prooued in maner as foloweth. Take a certayne quantitie of water, and ſprynckle it by droppes vppon a drye (or duſtie) table: ſo ſhall the droppes partly ſhewe a Sphericall and ſwellyng forme remaynyng. But yf the table before be neuer ſo lyttle wette with water, the droppes ſprynckled thereon, ſhall flote abrode, and keepe no Sphericall or rounde forme, by reaſon of the moyſtneſſe whiche the table had before receiued of the water. It hath alſo oftentymes chaunced, that certayne Townes and landes haue ben drowned by ouerflowyng of ryuers neare vnto them. Neuertheleſſe, howe muche ſo euer ſuche waters increaſe and ryſe, there is no daunger, vntyll great ſhowres fallyng from heauen, doo thorowly wette the banckes, rampertes,

A notable experiment.

The water intendeth to globus forme.

Why the water dooth not ouerflowe the lande.

An experiment.

The drowning of certayne Regions.

or calleys of ſuche riuers. For when they (as we haue ſayde) be thorowly imbibed with moyſteneſſe, they cauſe the ouerflowyng and breache, whereof foloweth the ouerflowyng and drownyng of the region: and this may ſuffiſe for aduertiſement. Nowe therefore I come to the experience aforeſayde, ſhewed at Toleto by two Greekes: who takyng a chaulderon of great capaſitie, and the mouth turned downewarde, and ſo hangyng it in the ayre by ropes, they faſten certayne poſtes and boordes or ſhelues in the myddeſt of the chaldron where they place them ſelues with the fyre. Thē to make it hang ſtedfaſtly and equally, they compaſſe the circumference, brymme, or border thereof with leaden plommetes on euery ſyde equally, and made of equal weyght, leaſt any part of the circumference of the mouth of the chaldron when it is equally and ſoftly let downe into the water, ſhoulde ſooner touche the water then the whole circumference. For ſo ſhoulde the water eaſyly ouercome the ayre incloſed in the chaldron, and reſolue it into moyſture. But yf by due proportion the chaldron thus prepared, be fayre and ſoftely let downe into the water, the ayre incloſed in the chaldron (by reſiſtance of the water) ſhall violently make hym ſelfe place, not admittyng the water to enter. So the men there incloſed, ſhall ſo long remayne drye in the myddeſt of the water, vntyll ſucceſſe of tyme doo by reſpiration debilitate and conſume the incloſed ayre, turnyng it into groſſe humiditie ingroſſed by the coldneſſe and moyſtneſſe of the water: but yf in due tyme the chaldron be ſoftly and equally drawen out of the water, the men ſhal remaine drye, and the fyre not extinct, whiche alſo may thus be prooued: Take a cuppe of glaſſe of a certayne quantitie: the circumference of the mouth wherof, ſhalbe broder then the circumference of the bottome. In the mouth let be faſtened a little ſticke, tying thereto a threede: On the ſtycke, faſten a little candle of waxe, whoſe lyght may come onely to the myddeſt of the cuppe, leaſt to muche neareneſſe of the water myght ſuffocate the candle. Then proportionally (as in the former experiment) put the cup with the burnyng candle into a veſſel ful of water, & in due tyme drawe it out ſoftly and equally, ſo that no part of the mouth of the

circumfe-

This experiment may be proued with a great bell.

An other example of the foreſayd experiment.

circumference thereof be drawen out before the whole, or ſydelye: ſo ſhall the candle remayne alyue, as it was before. Theſe be naturall and Mathematicall Demonſtrations. Let not therefore the ignoraunt condemne our wrytynges, before they knowe what maye be doone by experience. It is nowe then no more a miracle, when it is knowen to be naturall: And thus is it in all other Sciences and experimentes, whiche the common people thynke to be impoſſible. As the lyke in growyng of certayne fruites, trees, and herbes, by art ſo helpyng nature, that they may ſpring and growe before their naturall tyme, euen in the harte of Wynter. It ſeemeth alſo a miracle to the common people, that in the tyme of moſte temperate ſeaſon, and great calmeneſſe on the ſea, Shyppes be helde faſte immoueable in the myddeſt of the ſea, and ſodaynely ſwalowed into the bowelles of the earth: whiche neuertheleſſe is doone naturally in mañer of an earthquake, and by lyke natural cauſe. The reaſon whereof, is, that the ayre as a moſte lyght Element, incloſed in the bowelles of the earth, ſtriuyng euer naturally to the circumference of the earth, as vnto his owne region. But the pores of the earth beyng ſtronglye ſtopped, and the ayre thereby agaynſt his nature forcibly incloſed, ſtryueth by violence to bruſt foorth, and ſo cleauyng the earth in the bottome of the ſea, and great abundance of water fallyng into the breache, euen from the hygheſt parte of the ſea in that place, with ſwalowyng attraction of the fal, draweth downe with it ſodainly the Ship or Shippes, whiche at that tyme approcheth neare vnto the place of that whyrlepoole. Furthermore, anye ignoraunt man woulde hardly beleeeue that the ſalt water of the ſea maye be made freſhe, and potable to be dronke, whiche neuertheleſſe maye be doone naturallye, as hath been often prooued dyuers wayes. Some doo this (as is wrytten in Gemma Philoſophica) puttyng the ſalte water in a veſſell playſtered or cruſted ouer with cleane Waxe, whiche diſtyllyng

through

A ſecrete knowen, is no more a miracle.

Ignorance cauſeth admiratiō

Whirlepooles deuouryng Shyppes.

The lyke of earthquakes, Gunnes, and vnderminyng.

The ſpirite of Demogorgon.

To make ſalt water freſhe.

There is a better way.

through the ſtrayte and narowe pores therof, leaueth the ſalt, which for his groſneſſe can not paſſe therby. The ſame may be done better by a Canon or Pype, fylled with grauell or litle ſtones, and that the ſalt water powred thereon, may diuers times paſſe through that Pype into an other veſſell.

⁂

¶ Of the Flowing, and Reflowing, (*that is*) *increaſe and decreaſe* of the Sea, with the cauſes therof, *more exactly then hytherto hath been declared by any.*

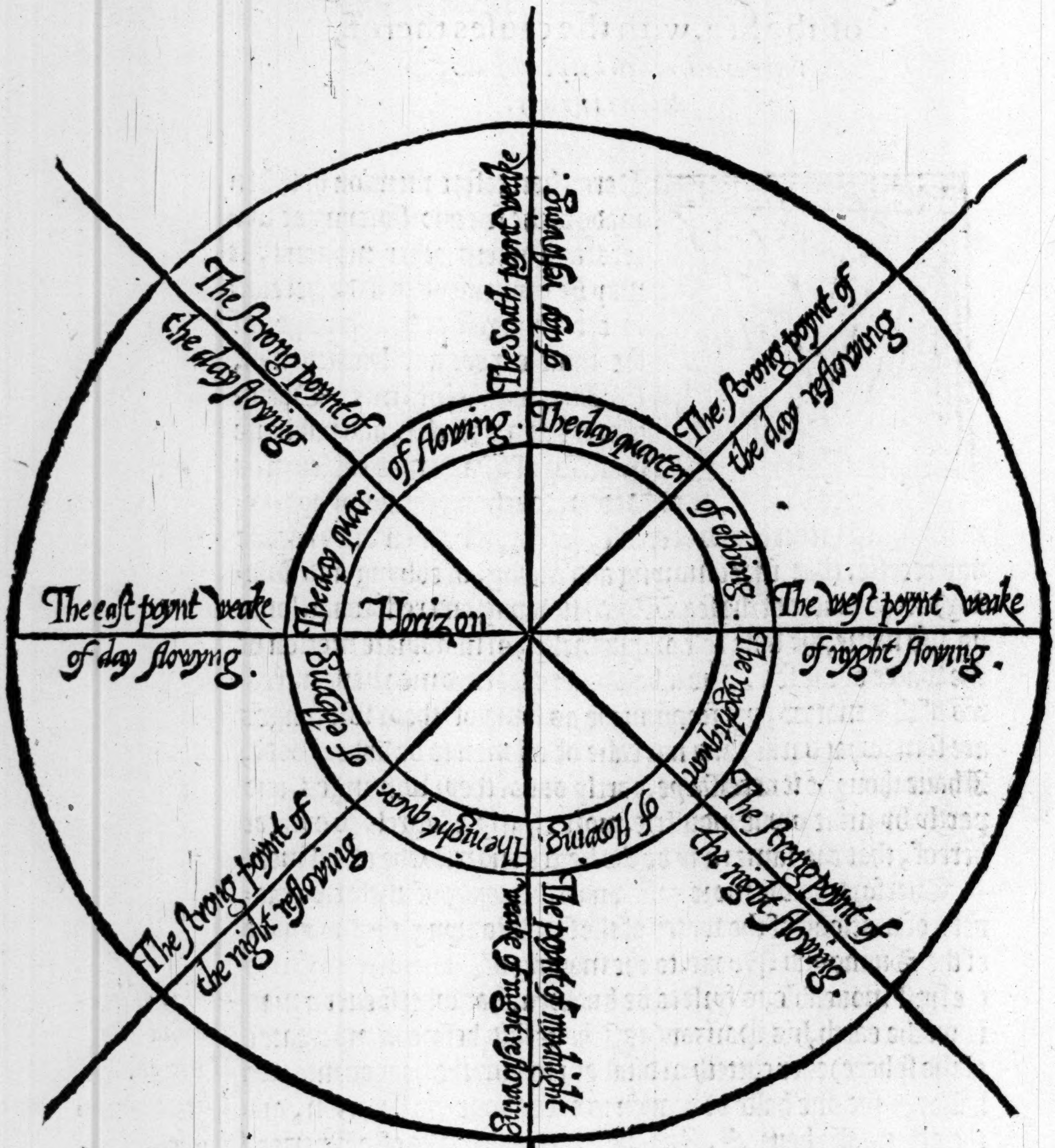
Wheras heretofore mention hath ben made of the ſea and flowyng of waters, and diuers other motions, it may be conuenient to adde hereunto the ſayinges and wrytynges of the moſt expert and learned man, Fredericus Delphinus, Doctor of artes and phiſicke, and publique profeſſor of Mathematical ſciences in the famous vniuerſitie of Padua, touchyng the flowyng & reflowyng, or increaſe and decreaſe, (otherwiſe alſo named acceſſe and receſſe, that is, commyng and goyng, or ebbyng and flowing) of the water of the ſea. Which flowyng and reflowing, ſome do alſo name, the falſe reſt or quietneſſe, or inordinate motion of the water of the ſea. And albeit diuers learned men haue intreated of this matter, yet foraſmuche as ſome of theyr wrytynges are ſomewhat darke, and not eaſie of all men to be vnderſtoode, I haue thought it neceſſarye, partly out of theyr wrytinges, and partly by mine owne induſtrie, more clearly & largely to entreat hereof, that the ſame may be the better vnderſtoode of all men.

Therfore, for the more eaſie vnderſtandyng of theſe two maners of motions of the water of the ſea, folowyng the mouyng of the Sunne and Moone, to the mouing of (primum mobile) the fyrſt moueable, is fyrſt to be knowen, that wherſoeuer a man is on the earth, his Horizon (as I haue ſaid before in my treatiſe of the ſphere) euer cutteth or diuideth to him the heauen into two halfes, & the one halfe of heauen is euer aboue his Horizon, and the other halfe beneath. And whereas in the halfe of a ſphericall or rounde body, are conteyned two quarters, two quarters ſhall

Diuiſiō of heauen and the Horizon.

The Horizon diuideth heauen into two partes.

A figure ſhewyng the beginning of the day increaſe at the Sunne riſing. and the beginning of the day decreaſe in the midday, and the beginning of the night increaſe at the Sunne ſetting, and the beginning of the night decreaſe at midnight.


The South poynt weake of day reflowing.
The ſtrong poynt of the day flowing
The ſtrong poynt of the day reflowing
of flowing. The day quarter of ebbing.
The day quar: of ebbing
The east poynt weake of day flowing.
Horizon
The west poynt weake of night flowing.
The night quarter of flowing
The night quar: of flowing
The ſtrong poynt of the night reflowing
The ſtrong poynt of the night flowing.
The poynt of midnight weake of night reflowing

euer be aboue his Horizon, & two beneath. Thoſe that are aboue the Horizon, are called diurnall or day quarters: & they that are vnder the Horizon, are called nocturnall or nyght quarters. Of theſe foure quarters of heauen, are two in the which is made the flowyng or increaſe of the water of the ſea: and other two in the which is made the reflowing or decreaſe of the ſea. The quarters in the which is made the flowing, is the quarter whiche is from the Eaſt to the South aboue the Horizon, whiche is the quarter of the day acceſſe, or increaſe of the day: and the quarter oppoſite or contrary, which is from the Weſt to midnight vnder the Horizon, is the quarter of the nyght acceſſe. The quarters in which is made the reflowyng or decreaſe, is the quarter which is from the South to the Weſt aboue the Horizon, which is the quarter of the receſſe of the day: and the quarter oppoſite, which is from mydnyght to the Eaſt vnder the Horizon, is the quarter of the receſſe of the nyght. &c.

Eyght pointes of heauen for flowyng and reflowyng.

Secondaryly, is alſo to be knowen, that there be in heauen eyght poyntes for the flowyng and reflowyng, or increaſe and decreaſe of the ſea: of the whiche, foure are ſtrong, and foure weake. Of the weake, two are weake for the flowyng, and two for the reflowyng. Weake for flowyng, are the poynt of the Eaſt, and poynt of the Weſt, whiche are the begynnyng of the two quarters of flowyng. Weake for reflowyng, are the poynt of the South or myddav, and the poynt of mydnyght, whiche are the begynnynges of the two quarters of reflowyng: and theſe foure poyntes are diſtant the one from the other, by a quarter of heauen. Of the ſtrong poyntes, two are ſtrong for flowyng, and two for reflowyng. Strong for the flowyng, are the middle poynt betweene the Eaſt and the South in the daye quarter of flowyng, beyng diſtant from the Eaſt. 45. degrees, and from the South lykewyſe: And the middle poynt betweene the Weſt and mydnyght, in the nyght quarter of flowyng, beyng diſtant from the Weſt 45. degrees, and from mydnyght lykewyſe. Poyntes ſtrong for the reflowyng, is the myddle poynt, betweene South and Weſt, in the day quarter of the reflowyng, beyng diſtant from the South. 45. degrees, and from the Weſt lykewyſe: And the myddle poynt betweene midnight and the Eaſt, in the quarter of the nyght reflowyng, beyng diſtant from mydnyght.45.degrees, and from the Eaſt lykewyſe. And as the weake poyntes are diſtant one from the other by a quarter of heauen, ſo are alſo the ſtrong poyntes diſtant the one from the other by a quarter of heauen, to them that haue a ryght Horizon.

A right Horizon is when both the poles lye in the Horizon, & that is to them only which dwell vnder the Equinoctiall.

It is thyrdly to be knowen, that beſide the aforeſayde eyght poyntes, to ſuche as haue a ryght Horizon, there be many other poyntes equipollent or of equall vertue. And ſuche be all the poyntes of heauen equally diſtant from the foure principal poyntes of heauen, whiche foure principall poyntes are, the poynt of the Eaſt, poynt of the Weſt, poynt of the South, and poynt of mydnyght, or from the foure ſtrong poyntes of heauen, whiche is all one, yet in quarters of contrarie operation. For all ſuche poyntes are equipollent or of equall vertue in moouyng the water of the ſea: but in a ryght Horizon it is otherwyſe, as ſhal appeare hereafter.

Poyntes of equall vertue in moouyng the water of the ſea.

It is fourthly to be knowen, that the Sunne and Moone euery moneth, are togeather in one ſigne, degree, and minute. And this ſo beyng, is called the Coniunction of the Moone with the Sunne. From thence for the ſpace of eyght dayes, or there about, the Moone is departed from the Sunne by her proper motion by a fourth part of heauen: and this departyng is called the fyrſte quarter of the Moone with the Sunne. From thence in fourteene dayes, or thereabout, ſhe is departed from the ſunne by an other fourth parte of heauen, and ſo by the halfe of heauen: and this diſtance is called the oppoſition of the Moone with the Sunne, or the ful Moone. From thence to.21.dayes or thereabout, ſhe is departed from her oppoſition with the ſunne or full Moone by an other fourth part of the heauen, commyng towarde the Sunne: and this diſtance is called the ſeconde quadrature of the Moone with the Sunne, and then the Moone is diſtant from the Sunne by a fourth parte of heauen, as it was diſtant in the fyrſte quarter, and ſo commeth neare to Coniunction with the Sunne. From thence at thyrtie dayes, or thereabout, the Moone is agayne with the Sunne in coniunction, as it was fyrſt.

The aſpectes whiche the Moone maketh with the Sunne euery moneth.

The Sunne & Moone are the only cauſes of ebbyng and flowyng.

Fyftly and laſtly, is to be knowen that the Sunne & Moone, both togeather euery naturall day (whiche is the tyme of. 24. houres, to the mouyng of the fyrſt moueable) are the cauſes of flowyng and reflowyng, or increaſe and decreaſe of the water of the ſea twyſe. Theſe declarations premiſed, and wel kept in memorie, let vs declare howe the Sunne and Moone both togeather euery naturall day; to the moouyng of the fyrſte moueable, are the cauſes of the flowyng and reflowyng of the ſea. For yf theſe declarations be well helde in memorie, and eſpecially the quarters of heauen in whiche is the flowyng, and the quarters of heauen in whiche is the reflowyng, and whiche are the ſtrong poyntes for the flowyng, and ſtrong poyntes for the reflowyng, and whiche be the weake poyntes for the flowyng, and the weake poyntes for the reflowyng: theſe (I ſay) beyng kept in memorie, al the narration of the mouyng, and falſe quietneſſe of the ſea, ſhalbe cleare and manifeſt.

The Sunne & Moone beyng in coniunction, what effectes they haue in moouyng the water of the ſea.

Fyrſt of all (as touchyng the flowyng and reflowyng of the ſea to the mouing of the firſt moueable) it is to be knowen, that when the Sunne and Moone are ioyned togeather, which coniunction is called Nouilunium (that is) the new Moone, when they be moued to the moouyng of the fyrſte moueable (called Primum mobile) from the Eaſt to the South, becauſe the vertues both of the Sunne and Moone be vnite togeather, and both theſe Luminaries are moued continually to the moouyng of the firſt moueable by the quarter of the day flowyng, whiche is from the Eaſt to the Weſt, the day flowyng or increaſe of the ſea is continuall. And whyle they are moued frō the South to the Weſt, becauſe they are moued continuall by the day quarter of the reflowyng, the reflowyng ſtyll continueth. And whyle they are moued from the Weſt to mydnyght, becauſe they are then moued by the quarter of the nyght flowyng, the nyght flowyng is agayne continuall. And whyle they are moued from mydnyght to the Eaſt, becauſe they are then moued by the nyght quarter of reflowyng, the nyght reflowyng is agayne continuall. And thus twyſe in the naturall day is the flowyng or increaſe, and twyſe the reflowyng or decreaſe of the water of the ſea.

Ebbyng and flowyng twiſe in the naturall day.

It is agayne ſecondarylye to be knowen, that when the Moone after her coniunction with the Sunne, by her proper motion is departed from the Sunne towarde the Eaſt, accordyng to the order of the ſignes, goeyng towarde her fyrſte quadrature with the Sunne (whiche the Venetian Pilottes call, *il Quartirone*) euer before the Moone by her proper motion, come to that firſt quarter, whiche is the diſtaunce of the Moone from the Sunne towarde the Eaſt, accordyng to the order of the ſignes, by a quarter or fourth part of heauen, when the Sunne is ſo muche aboue the Horizon of the Eaſt parte in quarter of the day flowyng, howe muche the Moone is vnder the Horizon of the ſame parte of the Eaſt in the quarter of the nyght reflowyng, becauſe then the Sunne is ſo muche diſtant from the ſtrong poynt of the flowyng aboue the Horizon, as the Moone is diſtant from the ſtrong poynt of the reflowyng vnder the Horizon, they are equipollent and of equall vertue, therefore then is neyther flowyng nor reflowyng of the water of the ſea, but the water ſeemeth to ſtande: And then the Venetians ſaye, *L'aqua è ſtanca.* But when the Sunne by the motion of the firſt moueable, commeth neare to the ſtrong poynt of flowyng, whiche is aboue the Horizon in the day quarter of the flowyng, the Moone by the ſame motion of the firſte moueable, departeth ſo muche from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon in the nyght quarter of reflowyng, commyng towarde the weake poynt of the Eaſt flowyng: And then becauſe the Sunne is nearer to the ſtrong poynt of flowyng, whiche is aboue the Horizon in the day quarter of flowyng, then is the Moone in the ſtrong poynt of reflowyng, whiche is vnder the Horizon in the nyght quarter of the reflowyng, the reflowyng is weakened, and the flowyng is fortifyed: and then the water of the ſea begynneth to flowe. And howe muche more the Sunne approcheth to the ſtrong poynt of the flowing, which is aboue the Horizon in the day quarter of the flowyng, ſo much more the Moone is departed from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon in the nyght quarter of the reflowyng, approchyng to the weake poynt of the Eaſt flowyng, and therefore the flowyng continueth. But when the

A quarter of heauē is three ſignes.

A tyme wherin is neyther ebbyng nor flowyng.

Sunne by motion of the firſt moueable, commeth to the ſtrong poynt of the flowyng, whiche is aboue the Horizon in the day quarter of the flowyng, then the Moone is departed from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon in the nyght quarter of reflowyng, and is made neare to the weake poynt of the Eaſt flowyng, and therefore the flowyng yet continueth: But when the Moone ſhall come to the weake poynt of the Eaſt flowyng, ſhee then to the mouyng of the firſt moueable, is moued by the day quarter of flowyng, approchyng to the ſtrong poynt of flowyng, whiche is aboue the Horizon: And the Sunne, becauſe it is diſtant from the Moone leſſe then a quarter, ſhall lykewyſe be moued by the ſame day quarter of flowyng, approchyng to the weake poynt of the South reflowyng: And therefore becauſe both are mooued by the day quarter of the flowyng, the flowyng ſhall continue. And when the Sunne by the moouing of the fyrſt mooueable, commeth to the weake poynt of the South reflowyng, becauſe then the Moone is nearer to the ſtrong poynt of the flowyng, whiche is aboue the Horizon, then the Sunne to the ſtrong poynt of the reflowyng, whiche is aboue the Horizon in the day quarter of the reflowyng, the flowyng ſhall continue. And when the Moone ſhall come to the ſtrong poynt of the flowyng in the daye quarter of flowyng, the Sunne ſhall not yet be in the ſtrong poynt of the reflowyng in the day quarter of the reflowing, becauſe that the Sunne is diſtant from the Moone leſſe then a quarter, but wyll come to it: and then the Moone ſhall depart from the ſtrong poynt of the flowyng, and ſhalbe leſſe diſtant from it then the ſunne from the ſtrong poynt of reflowyng: and therefore the flowyng ſhall yet continue, vntyll the ſunne be ſo muche beyonde the South toward the Weſt in the day quarter of reflowyng, howe much the moone on this ſyde the South towarde the Eaſt in the day quarter of the flowyng: And then the ſunne ſhalbe ſo muche diſtant from the ſtrong poynt of the reflowyng whiche is aboue the Horizon, beyonde the South in the day quarter of the reflowyng, howe muche the moone from the ſtrong poynt of the flowyng, whiche is aboue the Horizon, before the South in the day quarter of flowyng: And incontinent, the Sunne and the moone ſhalbe equipollent or of equall ſtrength, & therfore ſhalbe no flowing nor reflowing, as we haue ſayd before. And when he ſunne by the motion of the fyrſt moueable, ſhall come to the ſtrong point of reflowing in yͤ day quarter of reflowyng, the moone by the ſame motion of the fyrſt moueable, ſhalbe departed ſo muche from the ſtrong poynt of flowyng in the day quarter of flowyng, commyng towarde the weake poynt of the South reflowing: and then the moone ſhalbe more diſtant from the ſtrong poynt of flowyng, then the ſunne from the ſtrong poynt of reflowyng: And ſo the ſunne ſhalbe ſtronger then the moone, and therefore then ſhall begynne the reflowyng, and ſhall continue accordyng that the ſunne ſhall approch to the ſtrong poynt of the reflowyng, in the day quarter of reflowyng: and the moone ſhalbe departed from the ſtrong poynt of the flowyng in the quarter of the day flowyng. And when the ſonne ſhal come to the ſtrong poynt of the reflowing, the moone ſhalbe departed from the ſtrong poynt of the flowyng, and therefore the reflowyng ſhall yet continue. And when the moone ſhall come to the weake poynt of the South reflowyng, the ſunne ſhalbe departed from the ſtrong poynt of the reflowyng, in the day quarter of the reflowyng, commyng toward the weake poynt of the Weſt flowyng: Yet ſhall the ſunne be leſſe diſtant from the ſtrong poynt of the reflowyng, then the moone from the ſtrong poynt of the flowyng, and therefore the reflowyng ſhall yet continue. And when the ſunne ſhall come to the weake poynt of the Weſt flowyng, the moone ſhalbe neare to the ſtrong poynt of reflowyng, which is aboue the Horizon in the day quarter of reflowyng, and ſhalbe leſſe diſtant from it, then the ſunne from the ſtrong poynt of the flowyng, whiche is vnder the Horizon in the nyght quarter of flowyng, becauſe ſhe is diſtant from the ſunne leſſe then a quarter or fourth part of heauen: therefore the reflowyng ſhall yet continue, vntyll the ſunne ſhalbe ſo much vnder the Horizon on the Weſt part in the quarter of the nyght flowyng, howe muche the moone is aboue the Horizon on the ſame part of the Weſt in the day quarter of reflowyng. And becauſe then the Sunne ſhalbe ſo much diſtaunt from the ſtrong poynt of the flowyng, whiche is vnder the Horizon on the Weaſt parte, in the nyght quarter of flowyng, as the Moone from the ſtrong poynt of reflowyng, whiche is aboue the Horizon, on that parte of the Weaſt in the day quarter of reflowyng: then the Sunne and the Moone ſhalbe equipollent (that is) of equal ſtrength and vertue, and ſo ſhal there be neyther flowyng nor reflowyng. But when the Sunne, by the moouyng of the fyrſt mooueable, ſhall come to the ſtrong poynt of the flowyng, whiche is vnder the Horizon in the nyght quarter of the flowyng, the Moone by the ſame moouyng of the fyrſt mooueable, ſhalbe departed as much from the ſtrong poynt of reflowyng, whiche is aboue the Horizon in the day quarter of reflowyng: And then the Sunne ſhalbe leſſe diſtaunt from the ſtrong poynt of flowyng, in the nyght quarter of the flowyng, then the Moone from the ſtrong poynt of reflowyng, in the day quarter of reflowyng, and therfore the Sunne ſhalbe ſtronger then the Moone: and then agayne ſhall begynne the flowyng, and ſhall continue (as is ſayde before) vntyll the Sunne be ſo muche beyonde mydnyght towarde the Eaſt, in the nyght quarter of reflowyng, howe much the Moone on this ſyde mydnyght, toward the Weaſt, in the nyght quarter of flowyng, and then the Sunne ſhalbe ſo muche diſtaunt from the ſtrong poynt of the reflowyng, as the Moone from the ſtrong poynt of the flowyng: and then incontinent the Sunne and the Moone ſhalbe of equal ſtrength, and there ſhalbe nother flowyng nor reflowyng. But when the Sunne, by the moouyng of the fyrſt mooueable, commeth to the ſtrong poynt of the reflowyng, in the nyght quarter of reflowyng, the Moone by the ſame moouyng of the fyrſt mooueable, goeth backe, & is departed as muche from the ſtrong poynt of the flowyng, in the night quarter of the flowyng, comming to ẏ weake poynt of midnight reflowyng: And then the Sunne ſhalbe leſſe diſtaunt from the ſtrong poynt of the reflowyng, in the nyght quarter of the flowyng, then the Moone from the ſtrong poynt of flowyng in the nyght quarter of flowyng: and then ſhal the flowyng be weakened, and the reflowyng ſtrengthened, and the water of the ſea ſhall then agayne begyn to reflowe, whiche reflowyng ſhal con-

tinue

time (as is ſayde before) vntyll the Sunne be ſo muche aboue the Horizon on the Eaſt parte, howe muche the Moone vnder the Horizon on the ſame parte of the Eaſt: And then the Sunne ſhalbe ſo muche diſtaunt from the ſtrong poynt of the flowyng, whiche is aboue the Horizon, in the day quarter of the flowyng, howe much the Moone from the ſtrong poynt of the reflowing, whiche is vnder the Horizon in the nyght quarter of the reflowyng: and then the Sunne and Moone agayne ſhalbe of equall ſtrength, and there ſhalbe nother flowyng nor reflowyng. Then daylye (that is to ſay, in euery naturall day) ſhall returne the lyke change to this aforeſaid, vntil the Moone by her proper motion, ſhall come to her fyrſte quadrature with the Sunne, which the Pilottes or Mariners Venetians, cal *il Quartirone*, as I haue ſayde before. And when the Moone ſhall come to her fyrſte quadrature with the Sunne, then when the Sunne ſhalbe in the weake poynt of the Eaſt for the flowyng, the Moone ſhalbe in the weake poynt of mydnyght, for the reflowyng: and then the Sunne ſhalbe ſo muche diſtaunt from the ſtrong poynt of the flowyng, which is aboue the Horizon, on the Eaſt parte, in the day quarter of the flowyng, howe muche the Moone from the ſtrong poynt of reflowyng, which is vnder the Horizon of the ſame part of the Eaſt, in the nyght quarter of the reflowyng: and ſo the Sunne and the Moone agayne ſhalbe of equall force and power, and there ſhalbe nother flowyng nor reflowyng notable, but onely ſmal, encreaſyng and diminiſhyng. And when the Sunne by the motion of the fyrſt mooueable, ſhal come to the ſtrong poynt of the flowyng, whiche is aboue the Horizon, on the Eaſt part, in the day quarter of the flowing, the Moone by the ſame motion of the fyrſte mooueable, ſhall come lykewyſe ſo muche to the ſtrong poynt of the reflowyng, whiche is vnder the Horizon on the ſame parte of the Eaſt, in the night quarter of the reflowyng: and continually to the diurnall or day motion, the Sunne ſhalbe diſtaunt ſo muche from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of the flowyng, howe muche the Moone from the ſtrong poynt of reflowyng, whiche is vnder the Horizon, in the nyght quarter of the reflowyng, and continentlye the Sunne and

The Moone being in quartile aſpect, or at the fyrſte with the quarter, ſomewhat effectes it cauſeth in ebbyng and flowyng.

A very litle ebbyng or flowyng.

Moone ſhalbe agayne of equall power, vntyl the Sunne by the moouyng of the fyrſt mooueable, ſhal come to the ſtrong poynt of flowyng, whiche is aboue the Horizon: And then lykewyſe the Moone ſhal come to the ſtrong poynt of reflowyng, whiche is vnder the Horizon, becauſe theſe poyntes are diſtaunt one from the other by a quarter of heauen, as the Sunne and Moone are diſtaunt from them ſelues by a quarter of he. And when the Sunne by the motion of the fyrſte mooueable, ſhall departe from the ſtrong poynt of the flowyng, whiche is aboue the Horizon in the day quarter of the flowyng, commyng towarde the weake poynt of the South, reflowyng, the Moone by the ſame motion of the fyrſte mooueable, ſhall lykewyſe departe as muche from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon, commyng towarde the weake poynt of the Eaſt flowyng, and the Sunne ſhalbe contynually diſtaunt ſo muche from the ſtrong poynt of flowyng, whiche is aboue the Horizon, howe much the Moone from the ſtrong poynt of reflowyng, whiche is vnder the Horizon, vntyll the ſame come to the weake poynt of the South reflowyng: and then the Moone lykewyſe ſhall come to the weake poynt of the Eaſt flowyng. And the Sunne and the Moone in all this tyme ſhalbe of equall ſtrength, and incontinently ſhalbe nother flowyng nor reflowyng notable, and ſhalbe after the ſame manner whyle the Sunne to the motion of the fyrſte mooueable, ſhalbe mooued from the South to the Weaſt, becauſe then the Moone by the ſame motion of the fyrſte mooueable, ſhalbe mooued from the Eaſt to the South: And lykewyſe, whyle the Sunne ſhalbe mooued from the Weaſt, to mydnyght, becauſe then the Moone ſhalbe mooued from the South, to the Weaſt: And lykewyſe, whyle the Sunne ſhalbe mooued from mydnyght to the Eaſt, becauſe the Moone ſhalbe mooued from the Weaſt to mydnyght. And ſo in all the tyme of one reuolution of heauen, whiche is one daye naturall of foure and twentie houres, the ſea ſhall neyther flowe nor reflowe ſenſiblye, but ſhall ſeeme to ſtande, becauſe the Sunne and the Moone in all the tyme of that reuo-

Eyght daies after the change, for the ſpace of. 24. houres, is neyther ebbyng nor flowyng ſenſible.

reuolution of heauen, ſhalbe euer of equall power, without any notable difference. And this chaunceth about the eight day after the coniunction of the Moone with the Sunne. And this falſe quietneſſe of the water of the ſea, the Venetians cal *Acqua de fele,* and vſe this manner of ſaying, *Da gli otto, à i noue, Lacqua non ſi moue.* From the eyght day to the nienth, the water mooueth not.

When the Moone ſhalbe departed from the Sunne, beyond the fyrſt quadrature, goyng towarde her oppoſition with the Sunne, then euer vntyll the Moone ſhall come vnto her oppoſition with the Sunne, when the Sunne ſhalbe ſo muche aboue the Horizon on the Eaſt part, in the day quarter of the flowyng, how much the Moone is vnder the Horizon on the ſame part of the Eaſt, in the nyght quarter of the reflowyng, the Sunne ſhalbe ſo muche diſtaunt from the ſtrong poynt of the flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, departyng from it by the motion of the fyrſt mooueable, and commyng to the weake poynt of the reflowyng, howe muche the Moone from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon, in the nyght quarter of the reflowyng, commyng to it by the ſame motion of the fyrſte mooueable: And then the Sunne and Moone ſhalbe agayne of equal power, and there ſhalbe neyther flowyng nor reflowyng. And when the Sunne by motion of the fyrſt moouable, ſhal come to the weake poynt of the South reflowyng, the Moone by the ſame motion of the fyrſt mooueable, ſhall approche or come neare as muche to the ſtrong poynt of the reflowyng, whiche is vnder the Horizon, in the nyght quarter of the reflowyng: and then the Moone ſhalbe nearer to the ſtrong poynt of the reflowyng, whiche is vnder the Horizon, in the nyght quarter of the reflowyng, then the Sunne to the ſtrong poynt of the flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, becauſe the Moone ſhalbe ſtronger then the Sunne: And accordyng that the Sunne by the motion of the fyrſt mooueable, ſhal approch to the weake poynt of the South reflowyng, the Moone by the ſame motion of the fyrſt moouable, ſhal approch as much to the ſtrong poynt of the reflowyng, whiche is vnder the Horizon. And ſo the reflowyng ſhall continue vntyll the Sunne come to the weake poynt of the South reflowyng. And when the Sunne by the motion of the fyrſte mooueable, ſhall departe from the weake poynt of the South reflowyng, and ſhalbe mooued by the day quarter of the reflowyng, approchyng to the ſtrong poynt of the reflowyng, the Moone by the ſame motion of the fyrſte mooueable, ſhall departe as muche from the ſtrong poynt of the reflowyng, whiche is vnder the Horizon, in the nyght quarter of the reflowyng, and ſhe ſhalbe alſo mooued by the quarter of reflowyng, as the Sunne commyng to the weake poynt of the Eaſt flowyng, becauſe the Sunne and the Moone are diſtaunt betweene them ſelues more then by a quarter of heauen: And ſo both ſhalbe mooued by the quarters of reflowyng, and therefore the reflowyng ſhall continue, vntyll the Sunne ſhalbe ſo muche beyonde the South, towarde the Weaſt, in the day quarter of the reflowyng, howe muche the Moone on this ſyde the South, towarde the Eaſt, in the day quarter of the flowyng. And then the Sunne ſhalbe ſo muche diſtaunt in the ſtrong poynt of reflowyng, in the day quarter of reflowyng, departyng from it by the motion of the fyrſte mooueable, towarde the Weaſt, howe muche the Moone from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of the flowyng, commyng to it: And ſo the Sunne and the Moone ſhalbe of equall force, and then ſhalbe neyther flowyng nor reflowyng. And when the Sunne by the motion of the fyrſte mooueable, ſhalbe departed from the ſtrong poynt of the reflowyng, which is aboue the Horizon, in the day quarter of the flowyng, commyng to the weake poynt of the Weaſt flowyng, the Moone by the ſame moouing of the fyrſt moouable, ſhall approch as much to the ſtrong poynt of the flowyng, whiche is aboue the Horizon, in the day quarter of the flowyng, and then the Moone ſhalbe nearer to the ſtrong poynt of the flowyng, in the day quarter of the flowyng, then the Sunne to the ſtrong poynt of the reflowyng, in the day quarter of the reflowyng: and ſo the Moone ſhalbe ſtronger then the Sunne, and then ſhal begynne the flowyng. And as the Sunne ſhal cõtinually be departed from the ſtrong poynt of reflowyng, in the day quarter of the reflowyng, ſo the Moone continually ſhal approche to the ſtrong poynt of flowyng, in the day quarter of the flowyng, and ſo the flowyng ſhall continue. And when the Sunne ſhal come to the weake poynt of the Weaſt flowing, the Moone ſhall yet mooue by the day quarter of the flowyng, becauſe the Sunne and the Moone are diſtaunt one from the other more then by a quarter of heauen: and then the Moone ſhalbe nearer to the ſtrong poynt of flowyng, in the quarter of the day flowing, then the Sunne to the ſtrong poynt of flowing, whiche is vnder the Horizon, in the nyght quarter of the flowyng, and therefore the flowyng ſhall continue. And when the Moone ſhall come to the weake poynt of the South reflowyng, the Sunne ſhall paſſe the weake poynt of the Weaſt flowyng, approchyng to the ſtrong poynt of the flowyng, whiche is vnder the Horizon, in the nyght quarter of the flowyng, and then the Sunne ſhalbe nearer the ſtrong poynt of the flowyng, which is vnder the Horizon, in the night quarter of the flowyng, then the Moone to the ſtrong poynt of the reflowyng, which is aboue the Horizon, in the day quarter of the reflowyng, and ſo the Sunne ſhalbe ſtronger then the Moone, and therefore the flowyng ſhall continue. And when the Sunne ſhall come to the ſtrong poynt of flowyng, whiche is vnder the Horizon, in the nyght quarter of the flowyng, the Moone ſhall not yet be in the ſtrong poynt of the reflowyng, whiche is aboue the Horizon, in the day quarter of the reflowyng, becauſe the Moone is diſtaunt from the Sunne more then by a quarter of heauen, and therefore the flowyng ſhall yet continue, vntyll the Sunne be ſo muche vnder the Horizon on the Weaſt parte, in the nyght quarter of the flowyng, howe muche the Moone aboue the Horizon on the ſame parte of the Weaſt, in the day quarter of the reflowyng :and then the Sunne ſhalbe ſo muche diſtaunt from the ſtrong poynt of the flowyng, whiche is vnder the Horizon in the nyght quarter of the flowyng, commyng to the weake poynt of midnight reflowyng, howe much the Moone from the ſtrong poynt of reflowyng, whiche is aboue the Horizon, in the day quarter of the reflowyng commyng to it: and therefore the Sunne and the Moone ſhalbe of equal ſtrength, and then ſhalbe neyther flowyng nor reflowyng. Afterwarde, when the Sunne

A long tyme of flowyng.

by the motion of the fyrſte mooueable, ſhalbe diſtaunt from the ſtrong poynt of the flowyng, whiche is vnder the Horizon on the Weaſt parte, in the nyght quarter of the flowyng, commyng towarde the weake poynt of mydnyght reflowyng, the Moone by the ſame motion of the fyrſte mooueable, ſhall approche as muche to the ſtrong poynt of reflowyng, whiche is aboue the Horizon, in the day quarter of the reflowyng commyng to it. And ſo the Moone ſhalbe nearer to the ſtrong poynt of reflowyng, then the Sunne to the ſtrong poynt of flowyng, and therfore the flowyng ſhall begynne, and ſhall continue in maner (as is ſayde) vntyll the Sunne be ſo muche beyonde mydnyght, toward the Eaſt, in the nyght quarter of reflowyng, howe much the Moone before mydnyght towarde the Weaſt, in the nyght quarter of flowyng: and then the Sunne ſhalbe ſo much diſtaunt from the ſtrong poynt of reflowyng, in the nyght quarter of reflowyng, goyng backwarde from it towarde the foreſayde weake poynt of the Eaſt flowyng, howe muche the Moone from the poynt of the ſtrong flowyng, in the nyght quarter of the flowyng commyng to it: and then the Sunne and the Moone ſhalbe of equall force, and there ſhalbe neyther flowyng nor reflowyng. And when the Sunne by the motion of the fyrſt mooueable, ſhalbe departed from the ſtrong poynt of reflowyng, vnder the Horizon, which is in the nyght quarter of reflowyng, commyng towarde the weake poynt of the Eaſt flowyng, the Moone by the ſame motion of the fyrſt moouable, ſhal approch as much to the ſtrong poynt of flowyng, which alſo is vnder the Horizon, in the nyght quarter of the flowyng commyng to it. And becauſe then the Moone is nearer to the ſtrong poynt of flowyng, whiche is in the nyght quarter of flowyng, then the Sunne to the ſtrong poynt of reflowyng, whiche is in the nyght quarter of reflowyng: then ſhall the flowyng begynne and continue in manner aforeſayde, vntyll the Sunne be ſo muche aboue the Horizon on the Eaſt parte, in the day quarter of flowyng, howe muche the Moone vnder the Horizon, on the ſame parte of the Eaſt, in the nyght quarter of reflowyng. And becauſe the Sunne ſhalbe ſo much diſtaunt from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, commyng by the motion of the fyrſt mooueable, towarde the weake poynt of the South reflowyng, howe muche the Moone from the ſtrong poynt of reflowyng, whiche is vnder the Horizon, in the nyght quarter of reflowyng, commyng by the ſame motion of the fyrſt mooueable towarde it, they ſhalbe of equall force, and ſo ſhalbe neyther flowyng nor reflowyng. And in this maner, the flowyng and reflowyng ſhall continue in euery naturall day, vntyll the Moone ſhall come to her oppoſition with the Sunne.

The Moone being in oppoſition with the Sunne, what effectes they haue in moouyng the water of the ſea.

And when the Moone ſhall come to her oppoſition with the Sunne, then when the Sunne ſhalbe in the weake poynt of the Eaſt flowyng, the Moone ſhal lykewyſe be in the weake poynt of the Weaſt flowyng: and then ſhal the flowyng begyn, and ſhall continue as long as the Sunne ſhalbe mooued to the moouyng of the fyrſte mooueable, from the weake poynt of the Eaſt flowyng, by the day quarter of the flowyng, to the weake poynt of the South reflowyng. And the Moone then in al this tyme, ſhalbe mooued lykewyſe to the moouyng of the fyrſte mooueable, from the weake poynt of the Weaſt flowyng, by the nyght quarter of flowyng, to the weake poynt of mydnyght reflowyng: and then the flowyng ſhall ceaſſe, and the reflowyng begynne, and continue as long as the Sunne at the moouyng of the fyrſte mooueable, ſhalbe mooued from the weake poynt of the South reflowyng, by the day quarter of reflowyng, vnto the weake poynt of the Weaſt flowyng, and the Moone in all that tyme ſhalbe mooued lykewyſe to the moouyng of the fyrſte mooueable, from the weake poynt of mydnyght reflowyng, by the nyght quarter of reflowyng, vnto the weake poynt of the Eaſt flowyng: and then the reflowyng ſhall ceaſſe, and the flowyng ſhall begynne agayne, and ſhall continue as long as the Sunne ſhalbe mooued to the motion of the fyrſte mooueable, from the weake poynt of the Weaſt flowyng, by the nyght quarter of the flowyng, vnto the weake poynt of mydnyght reflowyng. And then the Moone in al that time, by the ſame moouyng of the fyrſt mooueable, ſhall lykewyſe be mooued from the weake poynt of the Eaſt flowyng, by the day quarter of the flowyng, vnto the weake poynt of reflowyng: and then the flowyng

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ſhall ceaſſe, and the reflowyng begyn, and ſhall continue as long as the Sunne, by the mouyng of the firſt moueable, ſhalbe moued from the weake poynt of mydnyght reflowyng, by the night quarter of the reflowyng vnto the weake poynt of the Eaſt flowyng. And then the Moone in all this tyme by the ſame motion of the fyrſte moueable, ſhalbe moued lykewyſe from the weake poynt of the South reflowyng, by the day quarter of the reflowyng, vnto the weake poynt of the Weſt flowyng: and then the reflowyng ſhall ceaſſe.

The Moone paſt her oppoſition with the Sunne, what effectes they cauſe in mouyng the water of the ſea.

And when the Moone ſhall paſſe her oppoſition with the Sunne by her proper motion, goyng to her ſeconde quadrature with the Sunne, then when the Moone ſhalbe ſo muche aboue the Horizon on the Eaſt part in the day quarter of flowyng, how muche the Sunne vnder the Horizon on the ſame part of the Eaſt in the nyght quarter of the reflowyng, becauſe then the Moone ſhalbe ſo much diſtant from the ſtrong poynt of flowing whiche is aboue the Horizon in the day quarter of flowyng, how muche the Sunne from the ſtrong poynt of reflowyng, whiche is vnder the Horizon on the ſame parte of the Eaſt in the nyght quarter of reflowyng, then the Sunne and the Moone ſhalbe of equall power, and therefore ſhalbe neyther flowyng nor reflowyng. And when the Moone by motion of the fyrſte moueable, ſhalbe departed from the ſtrong poynt of flowyng, which is aboue the Horizon in the day quarter of flowyng, commyng towarde the weake poynt of the South reflowyng, the Sunne by the ſame motion of the fyrſte moueable, ſhall approche as muche to the ſtrong poynt of reflowyng, whiche is vnder the Horizon of the nyght quarter of reflowyng, commyng to it: and then becauſe the Sunne ſhalbe leſſe diſtant from the ſtrong poynt of reflowyng, whiche is vnder the Horizon on the Eaſt parte in the nyght quarter of reflowyng, then the Moone from the ſtrong poynt of flowyng, whiche is aboue the Horizon on the ſame parte of the Eaſt in the day quarter of flowyng, the reflowyng ſhall beginne and continue. And when the Moone by the motion of the firſte moueable, ſhall come to the weake poynt of the South reflowyng, the Sunne ſhall yet be vnder the Horizon in the nyght quarter of reflowyng, becauſe the Sunne and the Moone are diſtant frō them ſelues more then by a quarter of heauen, and then the Moone to the mouyng of the firſte moueable, ſhalbe moued by the day quarter of reflowyng, as alſo the Sunne in lyke maner by the nyght quarter of reflowyng, commyng to the ſtrong poynt of reflowyng in the day quarter of reflowyng, and ſo the reflowyng ſhall continue. And when the Moone ſhall approche to the ſtrong poynt of reflowyng in the day quarter of reflowyng, the Sunne ſhall approche to the weake poynt of the Eaſt flowyng, in the nyght quarter of reflowyng, and ſhalbe further diſtant from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, then the Moone from the ſtrong poynt of the reflowyng, whiche is lykewyſe aboue the Horizon in the day quarter of reflowyng: and ſo the reflowyng ſhall continue, vntyll the Moone be ſo muche beyonde the South towarde the Weſt in the day quarter of the reflowyng, as the Sunne before the South towarde the Eaſt in the day quarter of flowyng: and then the Moone ſhalbe ſo farre diſtant from the ſtrong poynt of reflowyng in the day quarter of reflowyng, howe muche the Sunne from the ſtrong poynt of flowyng in the day quarter of flowyng: and ſo the Sunne and the Moone ſhalbe of equall force, and there ſhalbe neyther flowyng nor reflowyng. And when the Moone by the motion of the firſte moueable, ſhall depart from the ſtrong poynt of reflowyng, commyng towarde the weake poynt of the Weſt reflowyng, the Sunne by the ſame motion of the firſte moueable, ſhall approche as muche to the ſtrong poynt of flowyng, in the day quarter of flowyng: And then becauſe the Sunne ſhalbe nearer to the ſtrong poynt of flowyng, whiche is in the day quarter of flowyng, then the Moone in the ſtrong poynt of reflowyng, whiche is in the day quarter of reflowyng, the flowyng ſhall begynne and continue accordyng that the Moone, to the mouyng of the fyrſte moueable, ſhalbe departed from the ſtrong poynt of reflowyng, in the day quarter of reflowyng, commyng towarde the weake poynt of the Weſt flowyng: and the Sunne ſhall approche to the ſtrong poynt of the flowyng, in the day quarter of the flowyng commyng to it.

And when the Moone to the mouyng of the fyrſte moueable, ſhall come to the weake poynt of the Weſt flowyng, the Sunne yet by the ſame motion of the firſt moueable, ſhall moue by the day quarter of the flowyng, becauſe the Sunne and Moone are diſtant the one from the other more then by a quarter of heauen: & the Sunne ſhalbe more neare to the ſtrõg poynt of the flowyng, in the day quarter of flowyng, then the Moone to the ſtrong poynt of reflowyng, in the day quarter of reflowyng, and therefore the flowyng ſhall continue. And when the Sunne ſhal come to the weake poynt of the South reflowyng, yͤ Moone ſhalbe vnder the Horizon on the Weſt part in the nyght quarter of the flowyng, and ſhalbe nearer to the ſtrong poynt of the flowyng, whiche is vnder the Horizon in the nyght quarter of the flowyng, then the Sunne to the ſtrong poynt of reflowyng, whiche is aboue the Horizon in the day quarter of reflowyng: And therefore the flowyng ſhall yet continue, vntyll the Moone be ſo muche vnder the Horizon on the Weſt parte, in the nyght quarter of the flowyng, howe muche the Sunne aboue the Horizon on the ſame part of the Weſt in the day quarter of the reflowyng. And then the Moone ſhalbe ſo muche diſtant from the ſtrong poynt of flowyng, vnder the Horizon in the nyght quarter of flowyng, commyng towarde the weake poynt of mydnyght reflowyng, howe muche the Sunne from the ſtrong poynt of reflowyng aboue the Horizon, in the day quarter of reflowyng commyng to it: and ſo the Sunne and Moone ſhalbe of equall ſtrength, and then ſhalbe neyther flowyng nor reflowyng. And when the Moone by the motion of the fyrſte moueable, ſhall departe from the ſtrong poynt of flowyng vnder the Horizon, in the nyght quarter of flowyng, commyng towarde the weake poynt of mydnyght reflowyng, the Sunne by the ſame motion of the firſte moueable, ſhall approche as muche to the ſtrong poynt of reflowyng, whiche is aboue the Horizon, in the day quarter of reflowyng commyng to it: And then the Sunne ſhalbe nearer to the ſtrong poynt of reflowyng, whiche is aboue the Horizon, in the day quarter of reflowyng, then the Moone to the ſtrong poynt of flowyng, whiche is vnder the Horizon, in the nyght quarter of flowyng.

And therefore then ſhall begynne the reflowyng, and ſhal continue accordyng that the Moone ſhall departe from the ſtrong poynt of flowyng, whiche is vnder the Horizon in the nyght quarter of flowyng, approchyng vnto the weake poynt of mydnyght reflowyng, and the Sunne ſhall approche to the ſtrong poynt of reflowing, which is aboue the Horizon in the day quarter of reflowyng. And when the Moone by the motion of the firſt moueable, ſhall come to the weake poynt of mydnyght reflowyng, the Sunne ſhal yet be aboue the Horizon on the Weſt part in the day quarter of reflowyng, commyng by the motion of the firſt moueable, to the weake poynt of the Weſt flowyng, becauſe the Sunne and the Moone are diſtant one from the other more then by a quarter: And then the Sunne ſhalbe more diſtant from the ſtrong poynt of flowyng, whiche is vnder the Horizon on the Weſt part in the quarter of the nyght flowyng, then the Moone from the ſtrong poynt of reflowyng, which alſo is vnder the Horizon on the part of the Eaſt in the night quarter of reflowyng. And therefore the reflowyng ſhall continue vntyll the Moone be ſo muche beyonde mydnyght towarde the Eaſt, how much the Sunne before mydnyght towarde the Weſt: and then the Moone ſhalbe ſo farre diſtant from the ſtrong poynt of reflowyng in the nyght quarter of reflowyng, goyng from it by the motion of the firſte moueable, and commyng to the weake poynt of the Eaſt flowyng, howe muche the Sunne from the poynt of flowyng in the nyght quarter of flowyng, commyng to it by the ſame motion of the firſte moueable: and ſo the Sunne and the Moone ſhalbe of equall force, and then ſhalbe neyther flowyng nor reflowyng. And when the Moone by the motion of the firſt moueable, ſhalbe departed from the ſtrong poynt of reflowyng, whiche is vnder the Horizon, on the Eaſt parte of the nyght quarter of reflowing toward the weake poynt of the Eaſt flowyng, the Sunne by the ſame mouyng of the fyrſt moueable, ſhall approche as muche to the ſtrong poynt of flowyng, whiche is vnder the Horizon on the Weſt part in the nyght quarter of flowyng commyng to it: And then becauſe the Moone ſhalbe more diſtant frō the ſtrong poynt of reflowyng, then the Sunne from the ſtrong poynt of flowyng, then ſhal begyn the flowyng, becauſe the Sunne ſhalbe ſtronger then the Moone. And howe muche more the Moone ſhalbe diſtant from the ſtrong poynt of reflowyng, in the nyght quarter of reflowyng, ſo much more the Sunne ſhall approch to the ſtrong poynt of flowing, in the night quarter of flowyng, and ſo the flowyng ſhall continue: and when the Moone ſhall come to the weake poynt of the Eaſt flowyng, the Sunne ſhall yet be in the nyght quarter of flowyng, becauſe the Sunne is diſtant from the Moone more then by a quarter of heauen, and the Sunne ſhalbe nearer to the ſtrong point of flowing in the night quarter of flowing, then the Moone to the ſtrong poynt of reflowyng, which is in the night quarter of reflowing: and ſo the flowing ſhal yet continue vntyl the Moone be ſo much aboue the Horizon on the Eaſt parte, howe muche the Sunne vnder the Horizon on the ſame parte of the Eaſt: And then the Moone ſhal ſo much be diſtant from the ſtrong point of flowing, whiche is aboue the Horizon in the day quarter of flowyng, departyng from it by the motion of the firſt moueable towarde the weake poynt of the South reflowyng, howe muche the Sunne from the ſtrong poynt of reflowyng, which is vnder the Horizon in the night quarter of reflowyng, commyng to it by the ſame motion of the firſt moueable. And then the Sunne & the Moone ſhalbe of equall force, and there ſhalbe neyther flowyng nor reflowyng, and the firſt diſpoſition ſhall returne agayne, and ſuche flowyng and reflowyng, ſhall continue euery natural day in this maner, vntyll the Moone ſhall come to her quadrature with the Sunne.

And when the Moone ſhalbe in the ſeconde quadrature, then the water of the ſea, ſhall neyther flowe nor reflowe, but ſhall ſeeme to be at reſt as it was in the firſt quadrature, in the which, in the whole reuolution of heauen, the Sunne and the Moone were euer of equall ſtrength for the cauſes there declared: for the ſame are the cauſes of the ſeconde quadrature, which are alſo of the fyrſt, and is about. 21. dayes. And this quietnes or ſtay of the water of the ſea (as is ſayde before) the Venetians call *Acqua de fele*, and vſe this ſaying: *Da vent'uno à venti due, l'acqua non va ne ſu, ne giu* From the. 21. to. 22. the water goeth neither vp nor downe.

The Moone beyng in the laſt quarter, cauſeth the ſame effectes as in the firſt.

And when the Moone by her proper motion ſhall paſſe this ſeconde quadrature, proceedyng to her coniunction with the Sunne, then the Moone ſhalbe diſtant from the Sunne, leſſe then the fourth parte of heauen. And then when ſhe ſhalbe ſo muche aboue the Horizon on the Eaſt parte, in the day quarter of flowyng, as the Sunne vnder the Horizon on the ſame parte of the Eaſt, in the nyght quarter of reflowyng, then the Moone ſhalbe ſo muche diſtant from the ſtrong poynt of flowyng, which is aboue the Horizon, in yͤ day quarter of flowyng, commyng to it by the motion of the fyrſte moueable, howe muche the Sunne from the ſtrong poynt of reflowyng, whiche is vnder the Horizon in the nyght quarter of reflowing, going from it by the ſame motion of the fyrſte moueable towarde the weake poynt of the Eaſt flowyng: and then the Sunne and the Moone ſhalbe of equall power, and there ſhalbe neyther flowyng nor reflowyng. And when the Moone by the motion of the fyrſt moueable, ſhall come to the ſtrong poynt of flowyng, whiche is aboue the Horizon in the day quarter of flowyng, the Sunne by the ſame motion of the firſt moueable, ſhall depart as muche from the ſtrong poynt of reflowyng, whiche is vnder the Horizon in the nyght quarter of reflowyng, toward the weake poynt of the Eaſt flowyng. And then becauſe the Moone ſhalbe leſſe diſtant from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, then the Sunne from the ſtrong poynt of reflowyng, the Moone ſhalbe ſtronger then the Sunne, and therefore then ſhall begynne the flowyng: and howe much more the Moone ſhall approche to the ſtrong poynt of flowyng, ſo muche more the Sunne ſhalbe diſtant from the ſtrong poynt of reflowyng, approching to the weake poynt of the Eaſt flowing, and therefore the flowyng ſhall continue. And when the Sunne by the mouyng of the fyrſte moueable, ſhall come to the weake poynt of the Eaſt flowyng, becauſe the Moone ſhall yet be in the day quarter of flowyng, for that ſhe is diſtant from the Sunne leſſe then a fourth parte of heauen, ſhe ſhalbe leſſe diſtant from the ſtrong poynt of flowyng, whiche is aboue the Horizon, in the day quarter of flowyng, then the Sunne from the ſtrong poynt of reflowyng, whiche is vnder the Horizon, in the nyght quarter of reflowyng, therefore the flowyng ſhall yet continue. And when the Moone ſhall come to the weake point of the South reflowyng, the Sunne ſhalbe aboue the Horizon, in the day quarter of flowyng, and ſhalbe nearer to the ſtrong poynt of flowyng, then the Moone to the ſtrong poynt of reflowyng, whiche is after mydday (or the South) in the day quarter of reflowyng, becauſe the Sunne is diſtant from the Moone leſſe then the fourth parte of heauen, and therefore the flowyng ſhall continue vntyll the Moone be ſo muche beyonde the South towarde the Weſt, in the day quarter of reflowyng, howe muche the Sunne before the South towarde the Eaſt, in the day quarter of flowyng: And then the Moone ſhalbe ſo muche diſtant from the ſtrong poynt of reflowyng, in the day quarter of reflowyng, commyng to it by the motion of the firſte moueable, howe muche the Sunne from the ſtrong poynt of flowyng, in the day quarter of flowyng, departyng from it by the ſame motion of the firſte moueable: and ſo the Sunne and the Moone ſhalbe of equall force, and there ſhalbe neyther flowyng nor reflowyng. And when the Moone by the motion of the firſte moueable, ſhal approch to the ſtrong poynt of reflowyng, in the day quarter of reflowyng, the Sunne by the ſame motion of the firſt moueable, ſhall goe backe and depart as muche from the ſtrong poynt of flowyng, in the day quarter of flowyng: and then the Moone ſhalbe nearer to the ſtrong poynt of reflowyng, in the day quarter of reflowyng, then the Sunne to the ſtrong poynt of flowyng, in the day quarter of flowyng: and ſo the Moone ſhalbe ſtronger then the Sunne, and therefore ſhall begynne the reflowyng: and the flowyng and reflowyng, ſhall continue in the ſame maner as is ſayde.

When the Moone departeth from her coniunction with the Sunne, and is not come to her firſt quadrature with the Sunne, and is betweene the coniunction and fyrſt quadrature, and when the Moone ſhall come to her coniunction with the Sunne, then agayne al the diſpoſitiõ before declared, ſhal returne in al poyntes in lyke maner as is ſayde. Therefore this motion of the water of the ſea whereof we haue ſpoken, is a motion folowyng the motion of the Sunne & Moone to the motion of the firſt moueable.

A briefe collection of all the premiſſes.

For yf you ſhall wel conſyder that we haue ſayde of the flowyng and reflowyng (that is) increaſe and decreaſe, or acceſſe and receſſe of the water of the ſea, you ſhall vnderſtande that the begynnynges of ſuche flowyng and reflowyng, and lykewyſe the reſt and quietneſſe, chaunce diuerſly in the houres of the day and the nyght: For they come not euer in the ſame houres of the day, as is manifeſtly knowen to ſuche as obſerue ſuche flowyng and reflowyng, or falſe reſt or quietneſſe of the water of the ſea. And therefore by the aforeſayde dooth appeare that the water of the ſea hath motion of flowyng, once in the day, and once in the nyght: and lykewyſe of reflowyng once in the day, and once in the nyght.

Ebbyng and flowyng begin not alwayes at one houre.

It is manifeſt alſo that the flowyng doth not begyn euer the ſame houre of the day or nyght, but at diuers houres: and lykewyſe the reflowyng.

Alſo the tyme of flowyng or reflowyng, proceedeth inordinately when the Moone is in her quadratures with the Sunne, that is, in the firſt or seconde.

There chaunceth ſometymes great increaſe of waters, ſometyme leſſe, ſometymes meane, when the Moone ſhalbe in any other place from the ſunne beſide theſe foure: That is to meane, in the coniunction, or oppoſition, or her firſt quadrature, or ſecond with the Sunne.

And as are ſometymes increaſes of waters, greater, leſſe, and meane, euen ſo are the decreaſes in lyke maner.

Great motions of the water in the coniunction of the Sunne and Moone.

Greateſt motions in oppoſition of the Sunne and Moone.

The greateſt concourſes and motions of waters, are when the Moone is in coniunction with the Sunne, & alſo the greateſt flowynges and reflowynges. Lykewyſe in oppoſition of the Moone with the Sunne, and greater then in the tyme of the coniunction of the Moone with the ſunne. For the ſuperior bodyes, by their motion & light, geue their influence into theſe inferior bodyes. And ſo much more as they haue of lyght, ſo much more & ſtronglyer they worke: and becauſe in oppoſitiō of the Moone with the Sunne, the Moone is ful of light, & her light is toward vs, therfore is it reaſonable yͤ then ſhould be cauſed greater flowynges and reflowyngs, then in her coniunction with the Sunne. Neuertheleſſe, becauſe that in her coniunction with the Sunne, the Sunne & Moone are both vnite together, and their vertues, therfore alſo are great encreaſynges and decreaſyngs of waters, becauſe both their vertues are vnite, as I haue ſayde, but yet greater in the oppoſition then in the coniunction, for cauſes before rehearſed.

The Moone beyng in her quadratures with the Sunne, the water of the ſea hath no determinate tyme of flowyng or reflowing, and then are the leſſe concourſes of waters, & leaſt flowing and reflowyng. And ſuche motion of the ſea, the Venetians call *De fele*: and then the water of the ſea hath no determinate begynnyng of flowyng or reflowyng, but is mooued inordinately in dyuers maner, ſometyme commyng, and ſometyme goyng. The cauſe of this diuerſitie is, becauſe the Sunne & the Moone, where ſo euer they ſhalbe in moouyng to the water equally, or as it were equally, haue contrarietie in what ſo euer poynt they ſhalbe. For in what ſo euer poynt the Sunne ſhalbe, the Moone ſhalbe in the point of oppoſite vertue, contrary to the place of the Sunne, or neare.

Smal motions of the water without determinate time alwayes in the quadratures of the Sunne and Moone.

And when the Moone ſhalbe without the ſayde foure places, then the water of the ſea ſhal begynne to come or goe. And when the Sunne and Moone ſhalbe in equall poyntes of vertue of the quarters of contrary operation, the concourſes of waters ſhalbe ſo muche the greater, in howe much the Moone ſhalbe nearer to her coniunction with the Sunne, or to the oppoſition: and ſo much the leſſe, in howe muche the Moone ſhalbe nearer to the quadratures, lykewyſe alſo the flowynges and reflowynges ſhalbe ſo muche the greater. For yf the Moone ſhalbe betweene her coniunction with the Sunne and the fyrſt quadrature, then the Moone to the mouyng of the fyrſte moueable, dooth folowe the Sunne in his ryſyng: and then ſhalbe the begynnyng of the day flowyng, of the day after the ryſyng of the Sunne, about three of the clocke, or before: that is to meane, when the Sunne ſhalbe ſo muche aboue the Horizon on the part of the Eaſt, in the day quarter of flowyng, howe muche the Moone vnder the Horizon on the ſame parte of the Eaſt, in the nyght quarter of reflowyng, becauſe then the Sunne & Moone ſhalbe of equall force, becauſe they ſhalbe in the poyntes of equal

Note.

The Moone foloweth the Sunne in ryſing.

When flowyng ſhalbe three houres after Sunne ryſing.

Ebbyng after noone.

vertue in the quarters of contrary operation, and the begynnyng of the nyght flowyng ſhalbe in the nyght, after the fal of the Sunne (that is) when the Sunne ſhalbe ſo muche vnder the Horizon, on the ſame parte of the Weaſt, in the day quarter of flowyng, howe muche the Moone vnder the Horizon on the ſame parte of the Weaſt, in the day quarter of reflowyng: And the begynnyng of the day reflowyng ſhalbe in the day after noone, when the Sunne ſhalbe ſo muche after noone, in the day quarter of reflowyng, howe muche the Moone before noone, in the day quarter of flowyng: And the begynnyng of the reflowyng of the nyght, ſhalbe in the day after mydnyght (that is) when the Sunne ſhalbe ſo muche after the poynt of mydnyght, in the nyght quarter of reflowyng, howe muche the Moone before hym in the nyght quarter of flowyng. And yf the Moone be betweene the fyrſte quadrature and the oppoſition, the Moone yet in her ryſyng foloweth the Sunne, and then ſhalbe the begynnyng of the day flowyng, in the day after noone, about euenyng (that is) a litle before or after, that when the Sunne ſhalbe ſo muche aboue the Horizon on the parte of the Weaſt, in the day quarter of reflowyng, howe muche the Moone aboue the Horizon on the parte of the Eaſt, in the day quarter of flowyng, and the begynnyng of the nyght flowyng, ſhalbe in the day before day (that is) about mornyng, before or after (that is) when the Sunne ſhalbe ſo muche vnder the Horizon on the parte of the Eaſt, in the nyght quarter of reflowyng, howe muche the Moone vnder the Horizon on the parte of the Weaſt, in the nyght quarter of flowyng: and the begynnyng of the day reflowyng, ſhalbe in the day before noone, when the Sunne ſhalbe ſo muche before the poynt of noone, howe much the Moone after the poynt of mydnyght. And the begynnyng of the nyght reflowyng, ſhalbe in the nyght, before mydnyght, when the Sunne ſhalbe ſo muche before the poynt of mydnyght, in the quarter of the nyght flowyng, howe muche the Moone after the poynt of noone, or myddAY, in the day quarter of reflowyng. And yf the Moone ſhalbe betweene the oppoſition of the Sunne, and her ſeconde quadrature with the Sunne, then the Moone in her

ryſyng

The Moone ryſing before the Sunne.

ryſyng, goeth before the Sunne, and then the begynnynges both of flowyng and reflowyng, be in lyke maner as they were when the Moone was betweene the coniunction and fyrſt quadrature. For the begynnyng of the day flowyng, ſhalbe in the day about three of the clocke, before or after (that is) when the Sunne ſhalbe ſo muche aboue the Horizon on the Eaſt parte, in the day quarter of flowyng, howe muche the Moone aboue the Horizon on the Weaſt parte, in the day quarter of reflowyng. And the begynnyng of the nyght flowyng ſhalbe in the nyght, when the Sunne ſhalbe ſo muche vnder the Horizon on the part of the Weaſt, in the nyght quarter of flowyng, howe muche the Moone vnder the Horizon on the parte of the Eaſt, in the nyght quarter of reflowyng: But the begynnyng of the day reflowyng, ſhalbe in the day after noone, when the Sunne ſhalbe ſo muche after the poynt of the South, in the day quarter of reflowyng, as the Moone before the poynt of mydnyght, in the nyght quarter of flowyng. And the begynnyng of the nyght reflowyng, ſhalbe in the day, when the Sunne ſhalbe ſo muche after the poynt of mydnyght, in the nyght quarter of reflowyng, howe muche the Moone before the poynt of noone, in the day quarter of flowyng. And yf the Moone ſhalbe betweene the ſeconde quadrature, and her coniunction with the Sunne, then the Moone alſo in her ryſyng ſhall goe before the Sunne: and then ſhalbe the begynnynges of flowyng and reflowyng in the ſame houres, as they be when the Moone is betweene the fyrſt quadrature and oppoſition: becauſe the begynning of the day flowyng, in the day after noone about euenyng, before or after, when the Sunne ſhalbe ſo muche aboue the Horizon on the part of the Weaſt, in the day quarter of reflowing, howe much the Moone vnder the Horizon on the ſame part of the Weaſt, in the nyght quarter of flowyng: and the beginning of the night flowing ſhalbe in the night, about mornyng, before or after, when the Sunne ſhalbe ſo muche vnder the Horizon on the parte of the Eaſt, in the nyght quarter of reflowyng, howe muche the Moone aboue the Horizon on the ſame parte of the Eaſt, in the day quarter of flowyng.

Note.

But

A general obſeruation for the beginnyug of ebbyng and flowyng.

Note.

But the begynnyng of the day reflowyng, ſhalbe in the day before noone, when the Moone ſhalbe ſo muche after the poynt of mydday, or the South, in the day quarter of reflowyng, howe muche the Sunne before it in the day quarter of flowyng, and the begynnyng of the nyght reflowyng ſhalbe in the nyght before mydnyght (that is) when the Moone ſhalbe ſo muche after the poynt of mydnyght, in the nyght quarter of reflowyng, howe much the Sunne before the poynt of mydnyght, in the nyght quarter of flowyng. And hereby it appeareth, that as wel the flowyng as reflowyng of the water of the ſea, begyn not euer in the ſame houres of the day or nyght: for the begynnyng of flowyng is eyther in the begynnyng of the day, or begynnyng of the nyght, whiche chaunceth, the Moone beyng in coniunction or oppoſition to the Sunne: or is before day from the mornynges towarde the day, or from the day, vntyll foure of the clocke, or thereabout, or is before Euenyng, towarde Euen tyde, and from thence to the Cocke crowyng, or thereabout: whiche chaunceth when the Moone is betweene her coniunction or oppoſition with the Sunne, or anye of the quadratures. The begynnyng of reflowyng is eyther at noone, or at mydnyght, as when the Moone is in coniunction or oppoſition with the Sunne, or is before noone, or after, or before mydnyght, or after, as when the Moone is betweene her coniunction or oppoſition with the Sunne, and anye of the quadratures. It is apparent alſo, that ſometymes the water of the ſea hath no determinate or certayne begynnyug, neyther order of flowyng or reflowyng, which chaunceth, the Moone beyng in her quadratures with the Sunne. It is manyfeſt alſo, that al flowyng of the water of the ſea, is cauſed by reſpect to the Horizon, on the parte of the Eaſt or Weaſt. And euery reflowyng by reſpecte to the Meridian, or to the poynt of mydday, or mydnyght.

In what Horizon this diſcourſe taketh place.

Here is alſo to be conſydered, that all that is ſayde, are moſte certaynely true in a ryght Horizon, but in an oblique or ſyde Horizon, they ſometymes fayle, as ſhalbe ſayde hereafter folowyng.

It chaunceth (as I haue ſayde) that the water of the ſea doth ſometime wander or decline from the order aboue preſcribed, yet commonly, and for the moſte parte keepeth that due order. Such maner of declynyng is after two ſortes: For there is eyther diſorder, or errour, in the houre of the begynnyng of the motion of the flowyng or reflowyng, or in the myddeſt of the motion: that is to meane, that they haue greater or leſſer courſes then at other tymes, or otherwyſe greater or leſſer increaſes and decreaſes. The errour commyng in the houre of motion, may come of three cauſes: As, by reaſon of the ſituation of the region, or by reaſon of the bodyes ſuperceleſtiall, or by change of the ayre. By reaſon of ſituation of regions, chaunceth diuerſitie onely in the houre of the begynnyng of the flowyng, becauſe the begynnyng thereof hath reſpecte to the Horizon, or is by reſpecte to the Horizon: for in the begynnyng of reflowyng is no diuerſitie nor errour, becauſe the begynnyng of the reflowyng, is by reſpecte to the Meridian circle. Agayne, by reaſon of the ſituation of the region, diuerſitie chaunceth thus, that is, that eyther the region is vnder the Equinoctial circle, or without it. And if it be vnder the circle, becauſe they haue a ryght Horizon, and the dayes be there euer equall with the nyghtes there, at all tymes of the yeere. That we haue ſayde of diuers houres of the begynnyng of flowyng, is certaynely true: But regions diſtaunt from the Equinoctiall, becauſe they haue a wyndyng or ſlope Horizon in them, the begynnynges of flowyng are as in regions vnder the Equinoctiall, onely in two tymes of the yeere: That is to ſay, in the Spryng tyme, or Equinoctial Vernal, and in the tyme of Autumne, or Equinoctiall Autumnall, that is to ſay, About the myddeſt of the Moneth of Marche, and about the myddeſt of the Moneth of September: But in other tymes of the yeere, or from the Vernal Equinoctial, by the whole Sommer, vntil the equinoctial Autumnal, it is otherwiſe, becauſe the begynnyng of the day flowyng, yf the flowyng be before noone, that is, about the mornyng, it ſhalbe later then it ought to be: That is to ſay, more of the day then is in regions vnder the Equinoctiall, and that becauſe, that in ſuche regions the day begynneth ſooner, or the Sunne ryſeth ſooner, then in regions

The beginning of flowyng is by reſpecte of the Horizon.

The begynnyng of ebbyng, is by reſpecte of the Meridian circle.

whiche

Two flowyngs in one day, and none in the nyght.

whiche are vnder the Equinoctiall: for the declynyng of the oblique or ſyde Horizon (although theſe regions be vnder one and the ſame Meridian.) But and yf the begynnyng of the day flowyng be after noone, that is, about euenyng, then ſuche begynnyng ſhalbe ſooner then it is in regions vnder the Equinoctial, (that is to ſay) in fewer houres of the day: becauſe that then the Sunne falleth latelyer then in regions whiche be vnder the Equinoctial. But the begynnyng of the nyght flowyng, yf it be before mydnyght, it is ſooner in the ſayde places or regions (that is to ſay) in leſſe tyme of the nyght, or in leſſe tyme after the fal of the Sunne, then in regions vnder the Equinoctiall: becauſe that then the nyght begynneth to them afterwarde. And yf the begynnyng of the nyght flowyng be after mydnyght (that is) towarde the day, it ſhalbe later (that is) of more houres, or more neare the day, then is in regions vnder the Equinoctiall: becauſe the Sunne ryſeth ſooner to them, then to thoſe that be vnder the Equinoctiall. And this diuerſitie groweth ſo much, that ſometyme it chaunceth to ſee two flowings in one day, and none in the nyght: whiche chaunceth for the inequalitie of the dayes, with their nyghtes. For in howe much the artificiall day ſhalbe longer then his nyght, ſo muche ſuche diuerſitie and errour groweth more euidently. Therefore in the longeſt dayes of the yeere, ſuche diuerſitie ſhall appeare manyfeſtly. But from the Equinoctiall Autumnal, by al Wynter, vntyl the Equinoctial Vernall, it is contrary: becauſe the begynnyng of the day flowyng, yf it be before noone, that is, about the mornyng, then ſhal it be ſooner then it ſhoulde be (that is to ſay) in fewer houres of the day, then it ſhoulde be in a ryght Horizon: for then the day begynneth latelyer, or the Sunne ryſeth latelyer to them that haue a wyndyng or crooked Horizon. And yf ſuch flowyng ſhalbe after noone (that is) about euenyng, then the begynnyng of ſuche flowyng ſhalbe later (that is) more towarde the euenyng, or nearer to the fallyng of the Sunne, then in regions which are vnder the Horizon: For in ſayde or crooked Horizon, the nyght is ſooner, and the Sunne falleth ſooner then in a ryght Horizon. Alſo, the begynnyng of the nyght flowyng, yf it ſhalbe before mydnyght, it ſhalbe later and more in the nyght, then in regions vnder the Equinoctial: becauſe then the nyght ſhal ſooner begynne in the crooked Horizon, then in the ryght, becauſe the Sunne fyrſte falleth in the crooked Horizon, then in the ryght. And yf the begynnyng of the nyght flowyng ſhalbe after mydnyght, that is, towarde the day, then ſuche begynnyng of flowyng in the crooked Horizon, ſhalbe ſooner (that is) in fewer houres of the nyght (that is) more before the day, or before the ryſyng of the Sunne, then ſhalbe in regions whiche be vnder the Equinoctiall: becauſe the Sunne ryſeth latelyer then in regions vnder the Equinoctiall. And ſuche diuerſitie groweth ſo muche, that ſometime ſhalbe two flowynges in the nyght, and none in the day: And this chaunceth for the inequalitie and encreaſe of the nyght aboue his day. For in howe muche the nyght ſhalbe longer then his day, ſo muche the more groweth ſuche diuerſitie: and therefore ſuche diuerſitie ſhall appeare greateſt in the longeſt nyght of the yeere. Wherefore, by the aforeſayde, it is manyfeſt, that howe much the nearer we ſhalbe to the Equinoctial, ſo muche the leſſe ſhall appeare the diuerſitie in the houre of the begynnyng of flowyng of the water: And how much the Sunne ſhalbe nearer vnto the ſtandings or ſtayinges of the Sunne (called Solſtitium) or the longeſt daies, & longeſt nightes, ſo much greater and more certaine ſhalbe the diuerſitie, and ſhal appeare more manyfeſtly. Furthermore, diuerſitie chaunceth by reaſon of the heauenly bodyes, and errour, not onely in the begynnings of flowyng, but alſo of reflowyng.

Note.

For when anye of the great and luminous Starres (as are Venus and Iupiter) ſhalbe about the Sunne or Moone, they helpe them in moouyng the water of the ſea: and therefore by this meanes alſo, they leaue their due order. Lykewyſe (as we haue ſayde) by reaſon of the change of the ayre, often tymes chaunceth diuerſitie and errour in the begynnynges of flowyng and reflowyng: For the violent diſpoſition of wyndes, vehemently blowyng, as well neare, as farre of, remoooueth the courſes of waters from their due order, ſometyme haſtenyng the flowyng, and ſometyme the reflowyng, and ſometyme ſtaying or ſlackyng them lykewyſe.

The influence of other Planettes, maye cauſe diſorder in ebbyng and flowyng. And lykewyſe vehement wyndes.

There chaunceth alſo errour in the mydſt of motion of waters, for as wel courſes of waters, as alſo flowynges and reflowyngs, ſometyme keepe not the due motion: For (as is ſayd) the diſpoſition of wyndes may either encreaſe or diminiſhe their courſes. Furthermore alſo, the ſtrayteneſſe or narowneſſe of places, by reaſon of Ilandes or mountaynes, cauſe great concourſes and diuerſities in many places. For where the ſea is ſtrayter or narower, there is the ſtronger courſe, as about the Iland Euboea, Nigropontis, and betweene Sicilia and Calabria is greatlye obſerued. Suche ſtraytes hynder the encreaſe of waters, becauſe leſſe quantitie paſſeth thereby, and therefore there the flowynges and reflowynges are leſſe. And hereupon it chaunceth, that in the Ocean ſea, are greateſt flowynges and reflowynges, becauſe there are no ſtraytes which may hynder or ſtay the courſes of waters, and by that meanes they haue their full and free courſe, and in more certayne order. But in our ſea, Mare Mediterraneum, it is otherwyſe. For what ſo euer water of the Ocean entreth therein, or commeth foorth, paſſeth from the Weaſt by one onely narowe ſtrayte: and therfore it can not in the flowyng be greatly fylled, neyther in the reflowyng be greatly emptied. And ſo conſequently, the motion of the water of yͤ ſea proceedeth not in certayne order. And to haue ſaide thus much of the diuers motions of the water of yͤ ſea, may ſuffiſe.

Narowneſſe of places may cauſe diſorder.

Demonſtration of Proportions *of Motions Locall, printed rather* for the learned Philoſopher, then the Mariner, yet the Mariner may learne many proper concluſions neceſſarie to be knowen.

To the godly and not enuious reader, Iohn Taiſnier Hannonius, wiſheth health. &c.

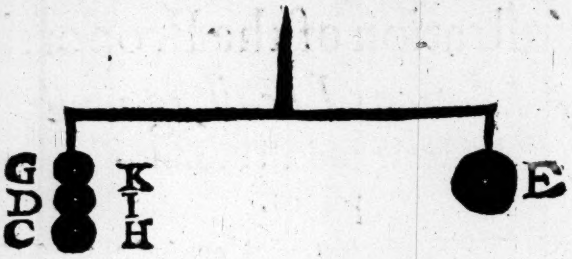
WHereas a fewe yeeres paſt, at Rome, Ferraria, and in other Vniuerſities of Italie (when Paul the third poſſeſſed the Papal dignitie) I tooke in hande to reade publique lectures of ſciences Mathematike, I may teſtifie without ſcruple of arrogancie, that my lectures were honourably accompanyed with the preſence of more then three hundred auditors, becauſe that artes Mathematike are there greatly eſteemed. And therefore after the lecture was finiſhed (as is the maner of auditors) oftentimes many reſorted vnto me, departing frō the ſcholes, to demaund further of ſuch doubtes, wherof they had not ful vnderſtanding. In the meane while, certaine which enuied my reputation and aſſertions, ceaſſed not with iniuries, to hynder our proceedinges, and ſometimes to make an ende of our diſputations with quarrels and ſtrokes. It chaunced in the meane tyme that mention was made of the lecture of Ariſtotel. *And whereas, from the purpoſe, one enuious perſon moued the queſtion of the Proportions of Locall Motions, I refuſed to diſpute with hym, affirming that he euyll vnderſtoode the intention of* Ariſtotel, *whom he ſo eſteemed as a heauenly God, that it ſeemed to hym ſacrilege, if any ſhoulde diſſent from his doctrine. But he, malitiouſly and furiouſly, affirmed that I dyd raſhly condemne* Ariſtotel. *I was therefore enforced by* the requeſt of my reuerende Cardinal of Adulphis Florentine, openly to repeate the ſame, eſpecially for that the reporte of theſe contentions, was nowe come to the Popes eares, whoſe requeſt alſo, I tooke for commaundement. And thereupon (whiche I had not doone before) I declared the errours of Ariſtotle, in the preſence of the reuerende Cardinal Creſcentius, and the Biſhop of Ponſet, men moſt expert in all kinde of learnyng, and in maner infinite other Auditours, before whom (in maner as foloweth) I ſhewed the errours of Ariſtotle by wordes and demonſtrations. You therefore gentle and indifferent readers, accept this our Demonſtration with fauourable myndes. I repute Ariſtotle for the chiefe of all Philoſophers. Yet foraſmuche as it is humane to erre, he alſo myght ſometymes fayle.

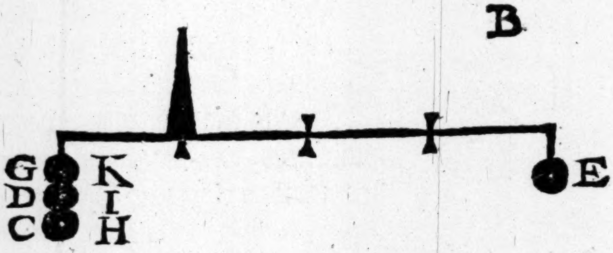
Demonſtration of the Proportions *of Motions Locall, agaynſt* Ariſtotle and all Philoſophers.

FIrst of al, and before we ſhall touch the poynt of the Demonſtration of Proportions of Motions locall, is to be noted, that of bodyes beyng of one and the ſame kinde, the like and ſelf ſame is the proportion betwene quantities, whiche is alſo betweene heauineſſe or lyghtneſſe, eyther ſimply, or in reſpect to other, it maketh no matter. It is yenough, that among them whoſe proportion we ſhall conſyder by quantitie, among the ſame lykewyſe, we ſhall vnderſtande by heauyneſſe and lyghtneſſe. &c. Let be for example two bodyes of leade, and vnequall, as A. and E. of the which the body A. ſhalbe triple in quantitie to the body E. for of the multiplication of the body, let no man be deceiued: for many haue thought the ſphere to be duplicate, when his Diameter is duplicate, whiche is a great errour, as appeareth by. 15. of the twelfth of Euclide. For there is ſhewed that the proportion of two ſpheres the one to the other, to be as it were the triplicate proportion of the Diameter of the greater ſphere, to the Diameter of the leſſe. Lykewiſe alſo is ſhewed in. 37. of the twel of ſolid bodyes lyke, and equidiſtant ſuperficies. Further. Albertus Durerus, ſpeaketh ſufficiently of this in his. 4. booke of Geometrie, teachyng the duplication of Cubus. &c. For then the ſame bodye A. ſhoulde exceede the body E. in heauyneſſe in triple proportion. Note therfore the weyght A. and the letter B. and E be ſigned F. and conceiue in minde the bodye A. to be diuided into three equal parts, that is to ſay, C D G. of the which partes, H I K. nowe is it manifeſt for the preſuppoſition, that euery part of, C D G. in equallitie ſhal correſpond to ẏ body E. and ſhal waygh by common ſcience, equally F. which yf it were

A[illegible]tus Durerus.

Cubus is a ſquare figure lyke a Dye.





not, euery part of A. ſhoulde not be reputed Homogenie, or all of one lyke ſubſtance with the body E. and ſo ſhoulde it repugne with the preſuppoſed. Therfore, foraſmuch as H I K. togeather is equiualent to B. only by common ſcience, ſhalbe alſo (by the 7. of the fyfth) B. to F. the ſame that is H I K. to the ſame F. but the weyght of H I K. is triple to F. by whiche reaſon the propoſition is manifeſt.

I wyll nowe make Demonſtration howe bodyes of the ſelfe ſame, or one kinde and figure, equall or vnequal one to the other, in the ſame middeſt or meane, by equall ſpace, be moued in one or ſelfe ſame time: the which is agaynſt Ariſtotel and all other philoſophers that haue not yet ſeene this propoſition. Ariſtotel firſt in the 4. of his phiſickes. Cap. De Vacuo, where he intendeth to ſhewe, that yf Vacuum, or voyde, be graunted, mouyng or motion is taken away, &c. he there ſayth thus, We ſee thoſe bodyes whiche haue more heauyneſſe or lyghtneſſe, ſo that they be of one figure, to be more ſwyftly moued by equal ſpace, and by ſuch proportion as they haue the one to the other. And therefore they are ſo moued, per Vacuum &c. which is proued to be falſe. Furthermore what S. Thomas ſayth touchyng this, any man that wil, may reade: for no man euer better vnderſtood ẏ minde

Thomas de Aquino.

of Ariſtotle. But for the examples which Simplicius and Auerroes geue to the vnderſtandyng of this (by two ſphericall bodyes of equal quantitie, but of diuers kindes, as one of gold, & the other of ſyluer) we muſt not therfore ſay that they vnderſtood this propoſition as I wyll demonſtrate. For they ſhoulde haue ſayde ſomewhat of the equalitie of the quantitie of thoſe bodyes, foraſmuche as the motion of bodyes equall or vnequall, is all one, ſo that they be all of one figure: as for example, yf there be three ſpherical bodyes, of the which two be of gold, and the thyrd of ſyluer, and they of golde be vnequall, and the other of ſyluer equal to one of the golden bodyes: then in the ſame proportion of tyme, ſhalbe moued the golden body equall to that of ſyluer, with the ſyluer body, in the whiche proportion the ſyluer body with the golden vnequall, as ſhalbe declared hereafter.

Motiō of the bodies of gold and ſiluer.

Furthermore. 6. Phiſicorum. Cap. 1. in the ende, and in maner through al the. 2. Chapter of the ſame booke, he confirmeth the ſame: but in the fourth he ſayth thus, Whereas euery thyng that moueth, moueth in ſome other, & in ſome time, and that moueable is motion of the whole, the ſame or all one ſhalbe the diuiſions of the tyme and the mouyng, and of to be moued, and of that which is moued, and alſo of that in the whiche is mouyng. Afterward he geueth demonſtration after his maner: but cap. 7. he wylleth the ſame, where he intendeth, that in finite tyme, nothyng may paſſe into infinite greatneſſe. &c. Furthermore Ariſtotle in his fyrſt booke, De Cœlo, confirmeth the ſame, ſaying ſimply that the reaſon or conſyderation of tymes, is contrary to the reaſon of weyghtes: as yf halfe a weight be moued in this time, the double is moued in the halfe of this. &c. And this cap. 6. Furthermore cap. 8. of the ſame booke he ſayth, The fire in as muche as it is greater then the earth, ſo muche the ſooner and ſwyftlyer it commeth to his reſtyng place. &c.

The motion of fyre.

Alſo in his ſeconde booke, De Cœlo. Cap. 8. he ſayth thus: As in other things, the greater body, is more ſwyftly moued by his proper courſe or motion, euen ſo alſo in the heauenly circles, &c. Agayne Cap. 13. he affirmeth the ſame in two places, ſaying that the greater earth, is euer ſwyftlyer moued.

Motion of heauenly circles.

Item, lib. De Cœlo. cap. 2. he ſayth thus, If accordyng to the proportion whiche hath the ſpace C D. the body of B. ſhalbe diuided, all B. in the ſame tyme ſhalbe moued by C E. in th whiche tyme parte of B. by C D. of neceſſitie: wherefore it followeth that B. be moued with ſwyfter motion then parte of B. Afterwarde he maketh lyke Demonſtration, ſaying thus, The ſwyftneſſe of the leſſe, to the ſwyftneſſe of the greater, hath ſuche proportion as the greater bodye to the leſſe, &c. Agayne in the thyrde, De Cœlo. Cap.5. in the ende he ſayth lykewyſe, that ſo muche the more euery thyng is moued, as it is the greater, as alſo the fire the greater it is, is ſo muche of ſwyfter motion, &c. He confirmeth the ſame alſo, Cap. 2. and 4. of the ſame booke, where yet ſpeakyng more clearely, he ſayth that the greater fire ryſeth vpwarde ſwyfter then a leſſe: and a greater peece of gold or leade, doth ſwyfter moue downewarde, and the lyke of other heauy bodyes: and more clearely can no man geather the meanyng of Ariſtotle.

The greater body the quicker motion.

The greater fire the ſwyfter motion.

Vitellio, in his ſeconde booke of Perſpectiue in the ſeconde propoſition, hath fallen into the ſame errour. I pretermit his ignorance in that propoſition where he thynketh that there is no quantitie inſenſible: but let this paſſe with other errours, the whiche at any other tyme ſhalbe ſhewed in theyr place. He that wyll reade all other Philoſophers, ſhall ſee that they all accorde with the mynde and ſentence of Ariſtotle, who alſo in diuers other places confirmeth the ſame: but to haue rehearſed theſe principall places, may ſuffiſe, and therefore we wyll nowe come to the Demonſtration.

Perſpectiue & errour of Vitellio.

This propounded Demonſtration, I wyll ſhew apparently, that it may the better be vnderſtoode. And foraſmuche, as Archimedes in his worke, De inſidentibus aquæ, hath ſpoken nothyng of the proportion of motion of Elementes, it is manifeſt that he had not yet ſearched this propoſition: for there was the proper place of this matter. But it is not graunted to any one man to knowe all thynges: and therefore it was very difficult to many to imagine the ſuppoſition, whiche I openly expounded in Rome, whereas Archimedes maketh none other Demonſtration, but that naturall motion is not cauſed of any other then of the exceſſe or proceedyng of a bodye in an Element,

Archimedes.

ment, aboue or vpon the ſayde Element, or contrarywyſe. &c.

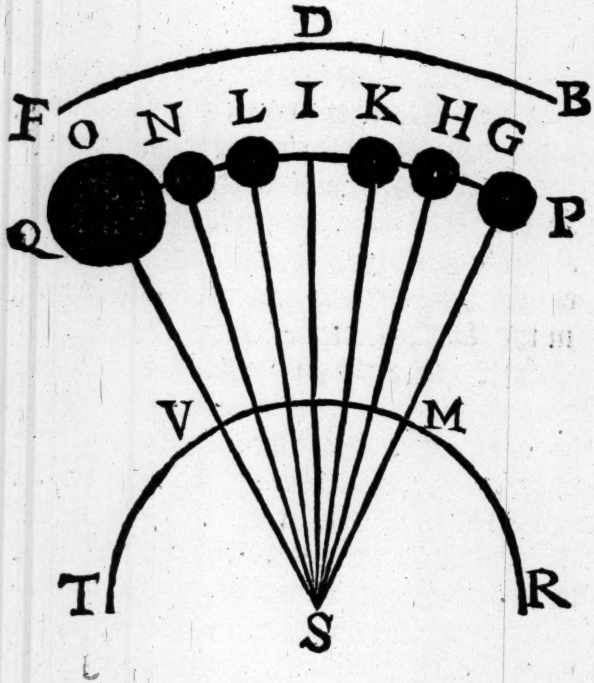
Demonſtration.

LET be for example two bodyes, G. and D. both alyke, that is to meane, ſpherical and Homogenie (that is) altogeather of lyke ſubſtaunce: of the which D. ſhal exceede G. in quadruple proportion (for yf it ſhall exceede it in quantitie, it ſhall alſo exceede in heauyneſſe as it is ſayde before) and that the meane or myddle be vniforme, as B D F M U. For example: let the termining lynes be equidiſtant, and the ſame alſo circular vpon the centre S. Then by the termynyng lyne, from whence, let paſſe, or be drawne the lyne. P I Q. and by the termynyng lyne to whom, let paſſe the lyne R M U T. Thus I conclude, the bodyes G. and D. to be moued in vnequall tyme by the ſayde ſpace, by the motion of nature in the aforeſayde meane: but yf the body D. were equall to the body G. there were no doubt, but that thoſe bodyes ſhoulde be moued in equall tyme by the ſame ſpace. &c. I wyll therefore by imagination diuide the body D. into foure equall partes, lyke vnto their whole. Let be therfore thoſe partes ſignified by the letters, H K L N. whoſe centers (for example) I wyll put in the lyne P Q. ſo that the diſtance betweene H. and K. be the ſame that is betweene L. and N. I wyll alſo diuide the lyne K L. by equalitie, by the 29. of the thyrde of Euclides in the poynt I. whiche ſhalbe the centre of the heauyneſſe of the bodyes H K. and L N. by common ſcience mainteyned, by the third propoſitiō of the booke of Archimedes, De centris grauium. Furthermore it is manifeſt, that euery one of the bodyes, H K L N. ſhalbe moued in equall tyme from the terminyng lyne or ſpace of P I Q. to the terminyng lyne R U M T. to that in the whiche is G. By the fyrſt conception therefore of Euclides, all bodyes, that is to meane H K L N. and G. paſſyng togeather from and at the ſame inſtant, ſhalbe moued

A quo

Ad quem.

equally, that is to ſay, in equall tyme: and euer the lyne paſſyng by their centres, ſhalbe equally diſtant to the lyne R M V T. Finally yf the lyne be vnderſtoode by the centre I. and the body D. diuided by equalitie or equall diſtance, then that poynt of diuiſion, ſhalbe the centre of the weyght H K L N. and D. by the aforeſayde. But nowe if that lyne be vnderſtoode to be moued by force of the foreſayde bodyes, and demiſſed from the lyne P Q. or equidiſtant to it (for thē alſo ſhould M V R T. be equidiſtant) by common ſenſe, M V R T. & the body D. in equall tyme by the motion of nature ſhalbe moued by the grāted ſpace, to that in the which the bodyes H K L N. ſhalbe mooued: For reſiſtaunce of the meane to the bodyes H K L N. is the ſame whiche is to the body D. But that this may appeare more manifeſt, let it be thus vnderſtoode. Let vs imagine (for example) two bodyes of water: Of the whiche, the one ſhalbe equall in quantitie to the body D and the other to the body G. or to one of the bodyes N L K H. whiche ſhalbe all one: then. 16. of the fyfth, the proportion of D. to G. or to one of the aforeſayde bodyes, is the ſame which is of the waterie equal D. to the waterie equall G. by the propoſition declared before.



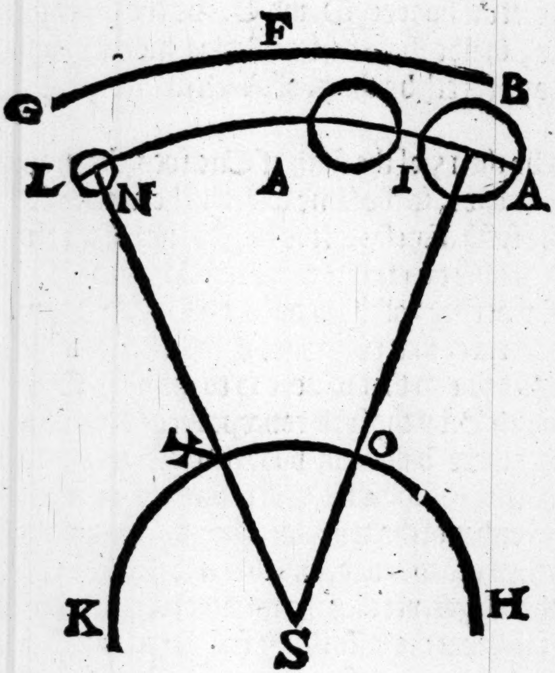
Proportion and motion of waterie bodyes.

The proportion of heauyneſſe of the watrie body equall D. to the heauyneſſe of the watrie body equall G. is the ſame whiche is betweene the quantities of the ſelfe ſame bodyes: But we muſt vnderſtande them to be ſuſteyned or weyghed in a rarer or thynner Element. The proportion therefore ſhalbe the ſame which is betwene the heauyneſſe of bodyes D. and G. by the. 11. of the fyfth, the aforeſayd propoſition helpyng thereto. Furthermore, let vs imagine the heauyneſſe of watrie bodyes, to be ſubſtract from the heauines of the bodyes, D. and G. So the other grauities or heauyneſſe, ſhalbe thoſe whiche ſhalbe mooued without impediment, as appeareth by the 7. of Archimedes, De inſidentibus aquæ.

And whereas by the 15, of the fyfth of Euclides, the proportion of theſe heauie bodyes, is the ſame which is betweene D. and G. by the. 19. of the fyfth aforeſayd: the reſyſtaunce of the meane or myddle to D. ſhalbe quadruple to the reſyſtance to G. The ſame alſo doo I ſay of euery of the bodyes N L K H. It appeareth by common ſcience, that reſyſtance of the meane to the bodyes N L K H. is equal to that whiche is to the body D. but is the ſame in the which G. by the fyrſt conception of Euclides.

Furthermore, yf there ſhalbe two bodyes of al one fygure, but of diuers homogeneite or ſubſtance, and of vnequal corporalitie, and (for example) either of them heauier then the meane or middle, in the which they are mooued, and that alſo the leſſe of them be heauier then the bigger, yet that the greater weygh more then the leſſe, then I ſay, that the leſſe ſhalbe ſwyfter in motion: and the ſame ſhalbe the proportion of tyme to the leſſe, whiche is to the greater, which is alſo the greater kynde of heauyneſſe to the kynde of yͤ leſſe, takyng away ſo much heauines from both, as is of the halfe in euery of them. Let be for example, two bodies M. and N. of the ſame fourme, & diuers homogeneite or ſubſtance, and the ſame alſo to be vnequal (for of equals there is no doubt) of the which, the greater ſhalbe M. but the kynde of the body N. to be heauier then the kynde of the body M. Puttyng the caſe alſo, that the body M. be heauier then the body N. & each of them alſo heauier then the meane or myddle body, by the whiche they mooue: then wyll I ſhewe the propoſition. Vnderſtande fyrſte

A V I. to be of equall and lyke fygure to the body M. but of the kynde of the body N. Let vs imagine alſo that the body M. in heauyneſſe, to exceede the myddle or meane in double proportion A V I. or in the eyght proportion: ſo then the mouyng of the body A V I. ſhall in the ſeuenth proportion be ſwyfter then the motion of the body M. becauſe the reſyſtance of the halfe to the bodye M. is ſubdupla, & to the body A V I. ſuboctupla, by yͤ ſeuenth of Archimedes, De inſidentibus aquæ. But by the aforeſayd Demonſtration, the body N. ſhalbe moued in the ſame tyme in whiche the body A V I. Wherefore, by the fyrſte conception of the minde added vppon Euclide by Campanus, the propoſition is cleare.



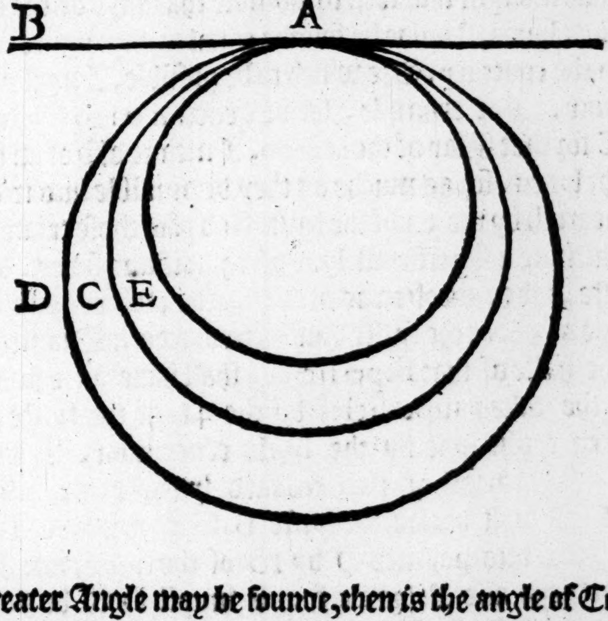
Motions violent and naturall.

The lyke reaſon is alſo of violent motions, takyng the proportion of the mouyng ſtrengthes, and takyng away the proportion of the reſyſtaunce of the halfe or myddle. Alſo, whereas are two equall angles aboue the Horizon, or vnder, but in contrary order to the motion of nature, becauſe violent motion is ſwyfter in the begynnyng then in the ende: and the contrary chaunceth in the motion of nature: For with violent motion, the motion of nature is euer ſomewhat myxt, yf horizontally or angulerly it ſhalbe aboue or beneathe the Horizon: and nature worketh ſo much, vntyl it bryng violent motion vnto ſome ende. But yf perpendiculerlye violence ſhalbe made aboue the Horizon, and towarde the place whiche that body naturally mooueth vnto, then nature can not ſtryue agaynſt or withſtande, but that violence doeth euer goe with it, in reſpecte of the ende from whence. Furthermore, by the aforeſayde, it is manyfeſt that to be falſe whiche Ariſtotle ſayth 7. Phyſic. in the laſt chapter, where he ſayth, Yf A. be that whiche mooueth B. and B. that whiche is mooued, and C. the longitude whereby, and D. the tyme in whiche the motion is, that is to ſay, in equall tyme and power equal. A. the halfe of B. ſhall mooue by the double of C. and by C. in the halfe of D. for ſo ſhalbe the ſimilitude of the reaſon. &c. That it is falſe I wyll thus demonſtrate. Let vs fyrſt imagine two bodyes as before, in any meane or myddle homogenie. &c. As let be for example. M. and N. and that M. be double in quantitie to the body N and that the weyght of N. be al one with the weyght of M. And alſo that the body A U I. be equal to the body M. in quantitie, & in lykeneſſe or kynde of the body N. Then by common ſcience, the body A U I. ſhalbe double in heauyneſſe to the body M. And grauntyng that the body M. be double in heauyneſſe aboue the halfe, then ſhall the body A U I. be quadruple in heauyneſſe aboue the ſayde halfe. Wherefore the reſyſtance taken away, let be left the tyme in the whiche the body A U I. to the tyme in the whiche M. is in proportion ſubtriple, or in the whiche the body A U I. in the ſame tyme ſhalbe mooued the body N. by the aforeſayd. Or yf in the ſame tyme the body N. ſhalbe mooued with the bodye M. yet the ſpace by the whiche N ſhalbe triple to that by whiche M. For the reaſon is all one of violent motions. The ſame ſhall preciſely come to paſſe, yf in the ſteade of the exceſſe of weyght aboue the halfe, we ſhal take the vertue or power moouyng. &c. as before.

Ariſtotle lykewyſe erreth in 4. Phyſic. Cap. 8. where he entreateth De vacuo, ſaying that the ſame, or al one, ſhalbe the proportion of motions of any body by diuers Elementes, which is betweene the ſame Elementes. As yf the ayre be in ſubtilitie double to the water, in double tyme B. the meane ſhall paſſe to that tyme, in whiche by the meane D. and C. the tyme ſhalbe double of the tyme E. &c. Nowe I ſhewe the errour of Ariſtotle. Let vs fyrſte vnderſtande, a body to paſſe through water by natural motion, as (for example) by a graunted ſpace, let vs alſo imagine that body in double to exceede the water in weyght, and that the water in heauyneſſe exceede the ayre in double proportion, then the graunted body ſhalbe quadruple to the ayre. Wherfore in the heauyneſſe, the reſyſtences of tyme taken away, in the whiche the motion of that body in the ayre, by equall ſpace to that, by the whiche in water to the tyme wherein by water in the graunted ſpace is mooued, the proportion ſhalbe ſubtriple, and not ſubduple, as Ariſtotle affyrmeth. Ariſtotle alſo erreth in the ſame Chapiter, ſuppoſyng that yf motion ſhoulde be graunted in voyde, the ſame or all one, ſhoulde be the reaſon of tyme to tyme, as is betwene moouyng bodyes: whiche is impoſſible by the aforeſayde. For thoſe bodyes ſhoulde be mooued in equall tyme, although they ſhoulde be of diuers kyndes, fourmes, and bygneſſe. By which place alſo is eaſye to gather, that the mynde of Ariſtotle was, that the proportion of motion to motion, is the ſame whiche greatneſſes haue betweene them, accordyng to heauyneſſe and lyghtneſſe ſimply. But that this alſo maye be more clearely vnderſtoode, imagine the bodyes M. and N. in voyde, and that the body N. be of the ſame weyght whiche. A V I. but of diuers kyndes, and conſequently, of diuers bygneſſe: then whereas thoſe bodyes haue no reſyſtence, there is no doubt but they ſhalbe mooued in equal tyme, by equal ſpace. I wyl take therfore the body A V I. of the kynde of the body N. but of the quantitie of the body M. nowe then by the meane of true methode of the demonſtration before ſhewed A V I. & N. ſhalbe moued in equall tyme with the body N. by equal ſpace. Wherefore, by the fyrſte conception in the ſame in the which M: wherfore it foloweth. &c.

The proportion of motion of Elementes.

Furthermore, alſo where Ariſtotle. 7. Phyſic. ſpeaketh of the compariſon of motions, ſaying that a ryght lyne is not comparable to a crooked lyne, becauſe there ſhould be found ſome ryght lyne equal of circuler lyne, eyther greater or leſſe. For whereas by reaſon of the definition geuen by him in 6. Phyſic. to the ſwyftneſſe and ſlowneſſe of motion, it ſeemeth to him that it can not be, that circuler motion ſhoulde be comparable to ryght motion. In the which he is manyfeſtly deceyued, & cheefely, thynkyng that a ryght lyne can not be founde equall, greater or leſſer to the circuler lyne: whereas Archimedes in the fyrſt propoſition of his Geometrie, ſheweth the contrary, and that by Mathematicall demonſtration, and not by the opinion of Ariſtotle. For Archimedes ſheweth there, by what meanes we may finde a ryght lyne greater or leſſe then any circuler lyne, conſtituyng fygures of right lynes without or within the circle. &c. But ſome man may ſay, that although a ryght lyne may be graunted greater or leſſe then anye circuler lyne, yet that the ſame can not be founde equal, whereas in. 15. of the. thyrde of Euclide, is ſhewed

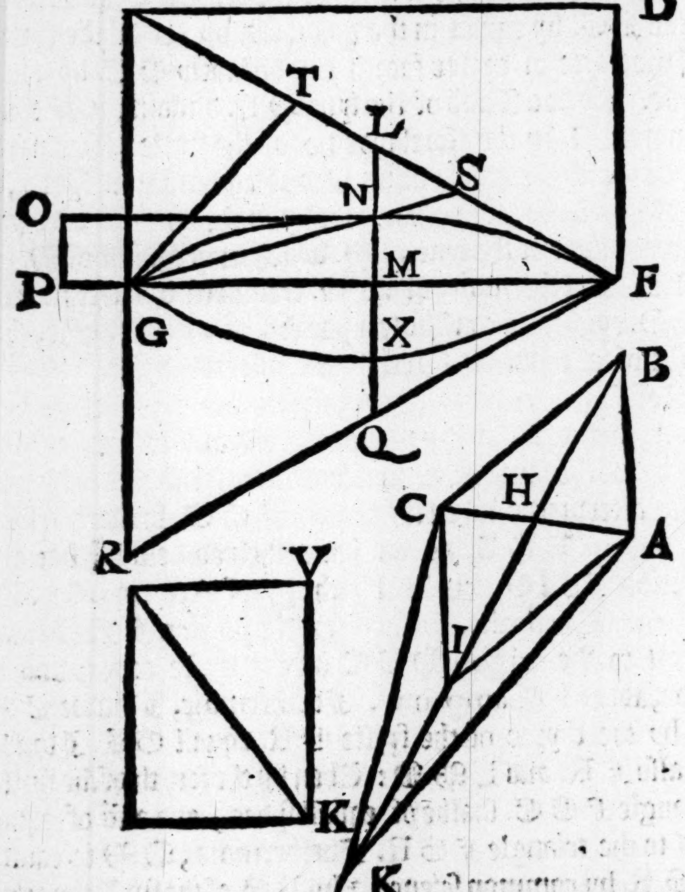


that a greater Angle may be founde, then is the angle of Contingence, and that by the motion of the ryght lyne of the greater angle, paſſage is made vnto the ryght lyne contingent or touchyng the circle: Yet that it can not be, that with the contingent lyne it ſhoulde make an angle equall to the angle of contingence. To this I anſweare, that although a greater angle be graunted, yet not a leſſe: For yf the leſſe ſhoulde be graunted as well as the greater, we ſhoulde lykewyſe haue an equall. For example, conſyder the circle A C. with the lyne A B. dooth touche in the poynt A. the angle of contingence ſhalbe A B C. then let be the circle inwardlye deſcribed A E. touchyng the circle A C. in the poynt A. for to one onely poynt it ſhall touche the circle A C. by 12. of the thyrde. And ſo the lyne A B. ſhall touche the circle A E by common ſcience, by the which the angle B A E. ſhoulde be greater then the angle B A C. Lykewyſe alſo, yf the circle A D. ſhalbe deſcribed outwardlye, the angle B A D. ſhoulde be leſſe then the angle B A C. And conſequently by the ſame order whereby we make the greater or the leſſe, we ſhal alſo conſtitute equall, whiche is the intent.

Wherefore it foloweth, that it may be done contrary to that whiche Ariſtotle ſayth, and for the ſame ſentence of Ariſtotle, ſome haue thought that it is impoſſible that anye of the fygures of crooked lynes, ſhoulde be founde equal to any fygure of ryght lyne, or the contrary. The which to be poſſible, I wyll nowe demonſtrate. For example, let be geuen a trigon or triangle A B C. for that I ſay of the trigon, I meane alſo of all fygures of ryght lynes, for as muche as they be diuiſible into triangles, as appeareth by the 32 of the fyrſt. And yf of thoſe triangles we ſhal conſtitute a ſuperficiall lyne of equidiſtant ſydes, by 44. of the fyrſte, taken as often as neede ſhalbe, whiche duplicate by the helpe of 36. of the fyrſte, and afterwarde a Diameter in it, then the halfe of that ſuperficies, ſhall haue an equall triangle of the taken ſuperficies by the 41. of the fyrſte, or by the taken ryght lyne by the fyrſte conception, I wyll conſtitute a ſuperficiall of two crooked lynes conteyned equall vnto it. I wyll diuide the fyrſte Baſis or grounde A C. by equall ſpaces into poyntes H. by 10 of the fyrſte, and I drawe B H. whiche alſo I drawe foorth vntyll H K. be double to B H. by 3. of the fyrſte twyſe aſſumpted. Then to the halfe of H K. that is I. I direct C I. and A I. I ioyne thereto alſo A K. and C K. by ryght lynes: then (by the fyrſt of the ſyxth) theſe triangles ſhalbe all equall to them ſelues. After this, I wyll conſtitute a ſuperficiall of equidiſtant ſydes, and of ryght angles vppon what ſo euer lyne, whiche ſuperficies ſhalbe equall to the Poligonie A B C K. by 44. of the fyrſte aſſumpted, as often as ſhalbe needefull, that ſuperficies is made G D. But in the whiche I drawe the Diameter F E. ſo that by 41. of the fyrſte trigon F G E. ſhalbe the halfe of the whole ſuperficies, and by common ſcience equal to the trigon B K C. and triplus to the trigon B H C. nowe I diuide F G. by equall in the poynt M. by 10. of the fyrſte, and I protracte or drawe foorth equidiſtantly G E. by 31. of the fyrſte. So doo I alſo of the lyne M L. diuiding it by equal in the poynt N. by the aforeſayde 10. of the fyrſte. Afterwarde by 44. of the fyrſte twyſe aſſumpted of equidiſtaunt ſydes, I make a ſuperficies of ryght angles vpon the lyne M N. equal to the quadrature of the lyne F M. which may conſyſt of M N. and N D. Furthermore, of M N. tranſuerſe or ouerthwarte, and N D. ryght, I conſtitute a parabol of a ryght angle, that it may be of leſſe labour: For this example may ſuffice by 52. of the fyrſt of Apolonius Pergeus, the terminyng lyne of which paraboll, ſhall paſſe by the poyntes F N. and G. by the ſame, and by 33. of the ſame F E. ſhal touch the parabol at the poynt F. And afterwarde when the trigon F E G. ſhalbe triplus, to the trigon B H C. as we haue ſhewed before, but alſo the portion F N G. triplus by the 17. of Archimedes, De quadratura Parabolæ. Wherefore the portion F N G. ſhalbe equall to the trigon H B C. by the fyrſte conception in Euclide, added by Campanus. Furthermore, I drawe E G. vntyll by the thyrde of the fyrſte G R, equall G R. I drawe foorth alſo F R. and L M Q: Then by the fourth of the fyrſte, the triangle F G E. ſhalbe of equall ſydes, and alſo of equall angles to the triangle F G R. Furthermore, Q M is equidiſtant G R. by common ſcience, & by R G. of the fyrſt, the angle F Q M. equal to the angle F R G. and the angle F R G. equal to the angle F M Q. and wheras the angle F R G. is cōmon to

Apollonius Pergeus.

eyther of them, then by the 4. of the ſyxt, the ſame, or al one, ſhalbe the proportion R G. to Q M. as is of G F. to M F. But as is G F. to M F. ſo is G F. to M L. Wherefore by N. of the fift, G F. ſo hath it ſelfe to M L. as G R. to Q M. But by the 16. of the ſame M L. to Q M. hath it ſelfe, as G F. to G R. Wherefore M L. equall. M Q. whiche M Q. I diuide by equall in the poynt X by 10. of the fyrſt, & wyl doo as before. Then by the reaſons aforeſayde of the ſame, the portion F X G: ſhalbe equall to the trigon A B H. and the whole Superficies F G. N X. ſhalbe equall to the whole trigon, A B C. whiche is propoſed.



The contrary appeareth thus. Let be graunted a Superficies, conteyned of two paraboll lynes, as F N G. and F X G.

pro

propoſing (for example) to fynde a ſuperficiall of ryght lynes trianguler equal to the graunted ſuperficies. I drawe fyrſt F G. Then after by 44. of the ſecond of Apollonius Pergeus, I find the Diameter of the parabol F N G. whiche is M N. whiche I draw to N L. to be equall M N. Then I drawe F L. which ſhal touch the parabol F N G. in the poynt F. by 33. of the firſt of the ſame. Then from the poynt G. I draw a lyne G E. equidiſtant frō the Diameter M N L. by 31. of the fyrſt of Euclide: whiche I drawe vntyll it ioyne togeather with F L. the whiche doubtleſſe ſhalbe done by the ſecond of the firſte of Vitellio.

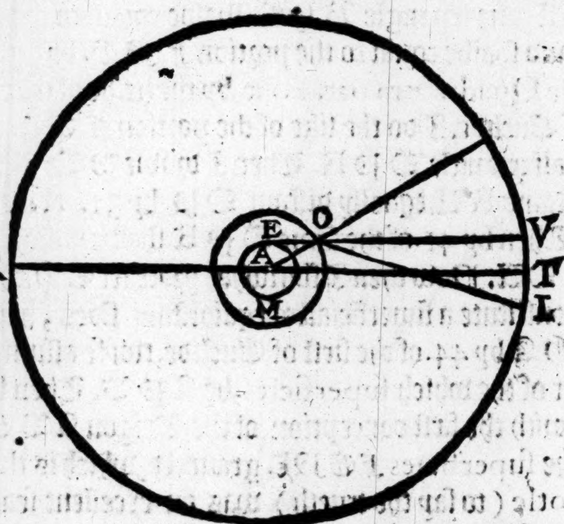
The poynt of the concourſe or ioyning togeather, is E. then I diuide F E. into three equal portions by the 11. of the ſyxth of Euclide, in the poyntes S. and T. which poyntes I ioyne with the poynt G. by the lynes F G. and G R. Nowe ſhall there be three angles all equall to them ſelues by 38. of Euclide. After this, I conſtitute a Trigon, B H C. equall to the Trigon, F S G. by this meanes I drawe forth H C. to the equalitie G S. by the 4. of the firſt of Euclide. Then at the poynt H. I deſigne an angle B H C. equall to the angle F S G. by 23. of the firſt of Euclide: and by 3. of the firſt of the ſame, I drawe H B. vntyl it be equall F S. Afterwarde I ioyne B C. by a lyne. Then by 4. of the firſt, the tryangle B H C. ſhalbe equall to the triangle F S G. and ſhalbe equal to the portion F N G. by 17. Archimedes, De Quadratura parabolæ, by the helpe of the firſt conception of Euclide. I do the like of the portion F G X to whom by an equall triangle D P R. Then I drawe P Q equally diſtant D R, and R V. equally diſtant D P. by 31. of the firſte of Euclide. Then by 41. of the ſame D P R. ſhalbe halfe of the ſuperficies D V. Now then I ſomwhat protract C H. then vpon B H. I conſtitute a ſuperficiall of equidiſtant ſides, hauyng an angle B H A by 44. of the firſt of Euclide, twyſe aſſumpted: the Diameter of the which ſuperficies, be A P B. Then by 41. of the ſame with the firſt conception of the Trigon A B C. ſhalbe equal of the ſuperficies F G N X. graunted, which is the intent.

Ariſtotle.

Ariſtotle (to ſay the trueth) was an excellent ſearcher of things: Yet I wyl not ſay as ſome ſay (which haue neuer read yͤ workes of Ariſtotle, or vnderſtande thē not) that euery word of

Ariſtotle, is almoſt a ſentence: ⁊ that Ariſtotle was the god of Philoſophers, ⁊ neuer erred in one worde, but was diuine in all things. Such miſerable men, if they knew what it were to ſpeake with Demonſtration, ⁊ what by experience to the ſenſe, woulde neuer haue ſaid ſuch thyngs. For by ſenſe ſimply, in thoſe things that are not properly ſenſible, we are oftentymes deceiued. And wheras we can not perceiue the deception, by the meane of that ſimple ſenſe, then it ſemeth to vs that the thing can not be, ⁊ that it is not in very deede as it appeareth to the ſenſe, as for example: Who is he that thinkyng not a reflexed forme on the ſuperficiall of water immoueable, to be ſeene of the ſame greatneſſe, as it is by a ryght longitude, by the meane of a Diaphane, geathered of a radiall lyne incident and reflecte: wheras this is falſe by G Q of the ſixth of Vitellio. For the ſuperficies of the water is ſpherical, as ſheweth Ariſtotle. 2. De Cœlo. Cap. 4. But better Archimedes in the 2. propoſition, De ſubſidentibus aquæ. And therfore when any ſtarre appeareth vnto vs aboue the Horizon, yet is it not in deede as it appeareth: but is rather vnder the Horizon, as appeareth by this Demonſtration. Let the ſtarre be I. the Horizon R A T. the earth E A M. whoſe center

The ſenſe iudgeth not truely of all thynges ſenſible.



is A. ⁊ the ſight E. the vapours O E. Then wheras the radiall lyne paſſyng from any rare, thynne, or tranſparent in anye tranſparent of more thyckneſſe, maketh a perpendiculer, by the 45. of the ſeconde of Vitellio, it is manyfeſt therefore the ſtarre I. to be ſeene by the lyne I D E. which lyne ſhalbe crooked, becauſe that ſimple ayre is thynner then vapours, and fyre thynner then ayre. Alſo the matter or ſubſtance of heauen is thynner then fyre, by 50. of the 10. of Vitellio. Furthermore, the hygher parte of the ayre is thynner then the lower parte. The ſame I ſay alſo of water and fyre (yf we may cal fyre the hygheſt part of the body, neare vnto the concauitie of the Moone) and of euery ſuperior part of Elementes. And ſo the ſtarre by the lyne D E. ſeemeth to be aboue the Horizon, in the poynt U. But Vitellio alſo in the tenth booke, in the propoſition 49. teacheth perſpetiuely, and howe it may be inſtrumentally prooued, howe the ſtarres maye be ſeene in the Horizon, without their proper places, by reaſon of incuruation or crookyng of the beames. Wherof it foloweth, that they doo not Mathematically define the Horizon, which ſay that it is the terminer or ender of the ſyght, and of the greateſt circles of the Sphere, wheras by the demonſtrations before, the circle endyng the ſyght, is cuttyng the Sphere in two vnequall portions, and that the hygher portion be greater then the lower. For yf the Horizon be the ender of the ſyght, and one of the greateſt circles, then the earth is not equally about the centre or middle of the worlde, or els the myddle of the worlde is without the earth. But yf the earth doeth equally compaſſe about the myddle, ergo the ender of the ſyght is not of the greateſt circles in the Sphere, or contraryly. Therefore yf we ſhal ſee any ſtarre aboue the ender of the ſyght, we ſhoulde not therefore thynke it to be in the twelfth ſtation of heauen (this is to be vnderſtood by reaſonable maner) for the vertue of the ſtarre appeareth cheefly in the great circle (whoſe Pole is Zenith) paſſyng by the 90. degree of the Equinoctial, from the interſection or diuidyng of the ſame with the Meridian toward the Eaſt. Furthermore, the difference betwéene the ender of the ſyght and the greater circle, is not of onely one Diameter of the ſtarre, but of degrees, whiche yf it were not, we coulde by no meanes vſe the propoſition 49. of Vitellio: And therefore it was no ſmall errour of them that

The thynneſſe and thyckneſſe of Elementes.

The true and falſe definition of the Horizō.

ſayd

ſayde that the Horizon is the ender of the ſyght, and one of the greateſt circles in the Sphere, & that euer the myddle of heauen appeareth vnto vs, for euermore thẽ halfe appeareth vnto vs: for the incuruation or crookyng of the beames. But he that wyl ſee more examples of theſe thynges, let hym reade the fourth booke of Vitellio, and the tenth, and ſomewhere the ſeconde and fyfth of the ſame. In euery of them he ſhal ſee ſomewhat howe eaſyly we may be deceyued by this ſenſe: and the lyke of other ſenſes is not to be doubted. Therfore not without weake & ſlender iudgement, they call Ariſtotle ſo diuine a Prince of Philoſophie, as though he could not erre. And therfore that excellent Philoſopher, and Diuine, Peter Arches, dyd very wyſely geue commendation and honour to Ariſtotle proportionally, and no further, but onely to God: To whom be all honour and glorie. So be it.

Proportion in cõmendation.

FINIS.